INFANCY

AND

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AN INTRODUCTORY MANUAL.

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"C'est le premier pas qui coûte."

PREFACE.

THE subject of this book is the maintenance of Health in infancy; not the treatment of disease, but its prevention.

The work is intended, in the first place, for the use of those pupil-midwives and other nurses who seek a scientific understanding of their work, so far as it affects the care of infants. The author does not assume that such readers have much acquaintance with technical terms, and will employ these as little as possible, but he does assume that they want something more than arbitrary rules and disconnected hints, and that they wish for a clear understanding of the principles which must guide their practice.

In the second place, it is hoped that these pages may be useful to those who are engaged in the interesting attempt to diffuse, by means of lectures and classes amongst various sections of the community, some sound knowledge concerning the care of infancy. The enormous infant mortality in our great cities, and the large extent to which maternal ignorance contributes to this, are facts only too easily demonstrable. We look forward to the time when instruction in Infant- and Child-rearing will be recognised as a necessary part of the education of every woman.

Thirdly, the requirements of the student and practitioner have been kept constantly in mind, and to such the references to authorities and some of the notes are principally addressed. With the elementary physiological facts of the subject the student will be familiar, but the practical information here given covers ground where many an otherwise accomplished hospital student finds his education most at

fault when commencing practice. In this respect the author has experience as a teacher to guide him, and the clinique of a North of England manufacturing centre supplies abundant practical exemplification of almost every sin against the hygiene of infancy that can be perpetrated. He has not attempted to introduce novel views and methods, but simply to state clearly what is best established and of greatest practical importance.

A sequel to this book, dealing with the care of childhood, may possibly be undertaken hereafter.

1 De Grey Terrace,
Leeds, *February*, 1895.

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NORMAL GROWTH AND DEVELOPMENT IN THE FIRST TWO YEARS OF LIFE.

THE NEW-BORN CHILD—SIGNS OF MATURITY.

After nine months' development within the womb, the child is ready for independent life in the world outside, and in due course the muscular walls of the womb expel by a more or less difficult and tedious process first the child, and then the structures which have hitherto enfolded it and connected it with the maternal organism. The following are the signs which show that the proper degree of development has been reached, and that birth has not taken place too soon :—

The Average Length.—The new-born child should have an average length of 50 centimetres, or 20 inches, the extremes being 48 to 54 centimetres, or 19·2 to 21·6 inches.* A length of 24½ inches has been recorded.† On the other hand, in cases of twins and triplets, full-term children of much less size have been noted. Rering gives a case where a twin measured 31·5 centimetres or 12·6 inches.‡

The Average Weight is 7 lbs., rather less in females and more in males. Variations between 6 lbs. and 8 lbs. are very common. A weight of 10 lbs. is uncommon, and of 12 lbs. most exceptional. Even greater weights are on record, and A. Martin, of Berlin, extracted a dead child which weighed fully 8 kilogrammes or 17·6 lbs. But extreme size involves proportionally great risk of still-birth. When the child's head reaches a certain size, it

* Winckel, *Lehrbuch der Geburtshülfe*, second edition.
† Galabin's *Midwifery*.
‡ *Praeger Med. Wochenschrift*, 1889, No. 25.

cannot pass the bony passage within the hip-bones without serious or fatal injury. The world has doubtless lost some of its greatest geniuses because their brains were too large for safe delivery.*

On the other hand, new-born children may weigh less than 6 lbs., or even as little as 5 lbs.; but in these extreme cases the child is most probably premature, or, if not, it is so puny and weak that its chances of surviving are very slight.

The Toe Nails should come well to the end of the toes, and the finger nails should slightly overlap the ends of the fingers, being a little more developed than the toe nails.

This is but one illustration of the interesting fact that in the unborn child the **upper extremities** develop more rapidly than the lower, so that at birth the arms are far more powerful and capable members than the legs. It will be a year before the child can walk, but already the strength of its grip is extraordinary. It will also be found that in children born prematurely, the legs are relatively too short. The centre of the body should come just above the navel. If it lies higher than this, immaturity is indicated.

The Skin of the mature child shows certain characteristics. It is reddish, but whiter than in the premature, in whom it is dusky or purplish-red. In the fifth month of womb life, the skin is covered all over by short down or lanugo. In this some see the traces of the hairy skin of earlier stages of evolution. After the fifth month, the lanugo begins to come away, and one of the signs of maturity is that there should be hardly any of this left except upon the shoulders.

A kind of cheesy varnish (*vernix caseosa*) covers the skin at birth to a greater or less extent. It consists of the secretion of the glands of the hair-follicles, mixed with epithelial scales and lanugo, which have been shed.

Fat.—There should be a fair amount of fat beneath the skin, giving a full rounded outline to the limbs; whereas premature children are apt to be thin, their limbs flaccid, their bony points prominent, and their faces wrinkled and old-looking.

Both the Testicles should be in their place. These lie within the abdomen until two months before birth, and then descend. But it sometimes happens that one or both have not yet descended. They will almost always make their appearance later, and have often under such circumstances been mistaken for rupture. We have known a truss actually applied to keep

* An ingenious writer has pointed out that Julius Cæsar's brain escaped such destruction through the circumstances of his birth.

the supposed rupture within the abdomen. At the same time, we may observe that the descended testis often lies at the upper part of the scrotum and almost in the groin.

At birth the child should cry vigorously, the movements of the limbs should be active, and the grip of the hand strong.

PREMATURE CHILDREN.

Seven months has been shown by experience to be the earliest age at which a child prematurely born has much chance of surviving. Born before twenty-eight weeks, the infant will probably die in a few hours or days. We shall, however, give some account hereafter of the marked success that has attended the system of rearing premature children practised by Tarnier and others of the French school (see Chapter iv.).

A Seven-Months Child will have an average length of 15 inches and a weight of 45 ounces. The body is very thin and slender, the skin uniformly red in colour. It is transparent, so that its vessels are easily seen. The finger nails fall short of the finger tips, and the toe nails are still more rudimentary. Down covers the greater part of the body, being least marked on the face. The cry is feeble, shrill, monotonous, like the whine of a young chicken. The breathing is feeble, and in watching the breathing movement, it will be seen that the chest walls move very little, and that it is chiefly the abdominal walls which rise and fall. The child's limbs move slowly and feebly. The infant is torpid, and has hardly strength to suck, and what is still more important, there may be a serious defect of swallowing power.*

Eight-Months Children present intermediate characters. Their average length is $16\frac{1}{2}$ or 17 inches. Their average weight is $4\frac{1}{2}$ to 5 lbs.

There is a very old traditional belief that eight-months children have a less chance of surviving than those born at the seventh month. The contrary is the fact, as might be expected. Tarnier, for instance, before the employment of his improved methods of rearing premature children, found a mortality of 78 per cent. amongst seven-months, and 39 per cent. amongst eight-months infants. But the belief, which is not extinct even to-day, can be found in writings attributed to Hippocrates,† and also in the Talmud. It seems probable that an old superstitious belief

* See Guéniot, *Gaz. des Hôpitaux*, Oct. 22 and 29, 1872.

† See the New Sydenham Society's *Hippocrates*, vol. i., p. 96. It is not certain whether Hippocrates himself is responsible for this teaching, but its antiquity is undoubted.

in the mystical power of the number seven may be the real foundation of a legend which has been accepted by generation after generation for more than two thousand years, and which the writer has himself heard repeated with all seriousness by members of the profession.

SIGNS OF RECENT BIRTH.

The new-born child will show signs of recent birth. The head will in almost all cases show a temporary alteration in shape. This is due partly to the actual moulding of the bones of the skull during the process of birth, the head becoming longer from before backwards. It is partly due to a soft swelling which forms during labour upon the part of the head which is lowest just before birth. This becomes swollen because every other part of the head is more pressed upon and squeezed than this. After a difficult labour the **disfigurement of the head** may be most marked; but the child's head will resume its natural shape, and the swelling will disappear in a day or two, so that there is no cause for anxiety, and no need for treatment; and especially is there no need for the nurse to try to press the head into shape with her hands. She had far better leave it alone. If the child was not born head first, a similar swelling may be in some other part of the body, the buttocks for example. In rare cases there is found upon the head a birth-swelling, which does not quickly go away, but which on the contrary may grow larger after birth, and may become of stony hardness, and not disappear for three months or more. This is a blood tumour under the scalp, and is due partly to injury during birth, and partly also, in all probability, to some obstruction of the circulation of the blood at the same time.* Spontaneous cure may be expected, and most cases are best left untreated.

Attached to the navel of the new-born child is the remnant of the **navel-string**. This will dry up and mummify, becoming hard and horny; for after it is tied at birth, blood soon ceases to enter it, its blood-vessels shrink up, and it becomes quite lifeless. It will come away usually in five or seven days, but it may remain attached for a much longer period. We have seen it remain for twenty-one days.

The process by which the cord-remnant separates is interesting.

* On the asphyxial theory of cephalhæmatoma neonatorum, see an article by Merttens, *Zeits. für Geb. u. Gynäkol.* Band xxiv., Heft 2. Abstract in *Med. Chronicle*, November, 1892.

A little red ring is seen to form where the cord joins the skin, then by a process of natural ulceration a furrow is formed, which deepens until it cuts off the stump. As the place of attachment contracts, meanwhile, the raw surface left when the stump forms is small, and it is usually overlapped by a fold of the skin at the navel. There will be a little thin discharge during the ulceration. Drying up is the normal process. Sometimes, especially in children who are not in good health, the drying up of the cord is delayed. In these cases the stump may become slightly offensive (see also p. 96).

EXAMINATION OF THE NEW-BORN CHILD.

The new-born infant must be examined to see whether it is free from **defects and malformations.** Of gross malformation or monstrosities we will not speak here, but the following are points which should be noted in the routine examination just after birth. They relate to defects which are more or less remediable by surgical means. There should be no cleft of the lip (hare-lip) or of the palate. The fingers and toes should be perfect in number. The fingers should be duly separated from each other, and not "webbed." The feet should not be contracted or "clubbed."

The general outline of the head, neck, trunk, and limbs should be normal. There should be no swelling along the spine. The genital organs should be well formed, and quite distinctive of the sex. The testicles in the male should be in their place, and there should be no rupture in the groin. The opening of the bowel (anus) should be normal, and urine and motions should pass in a few hours; occasionally the anus may be normal, but the bowel may be obstructed inside. There should be no abnormal marks upon the **skin.** We may say, however, that a very large number of infants do have upon their skins red stains (cutaneous nævi) more or less distinct. These are popularly called "mother's marks." They are also termed "birth marks," and ignorant people suppose that they are produced during labour, and we have even had them pointed out as the place where the accoucheur had "put his fingers." They usually disappear of their own accord in a few months or, at most, in a year or two. It is only when the nævus rises up above the level of the skin, and after a month or two is found to be growing larger, that treatment by the surgeon is needed.

The skin of a new-born infant will have a reddish colour of varying depth. In three or four days this will begin to fade,

and it may then assume a more or less yellowish tinge. This is not of serious importance. There is a jaundice of the new-born which sometimes occurs, and which is of serious nature. This is recognised by the fact that the whites of the eyes become yellow, and the urine, and perhaps the motions also, have the same colour, or are dark and blood-stained.

Blueness of the skin, especially on the face and extremities, is, on the other hand, a sign of defect in respiration or circulation, or both.

In two or three days a slight peeling of the skin will be noticed, and especially on the chest and belly. This will go on more or less for a month or six weeks. It occurs later in premature children (*Parrot*). The scalp of the infant is the densest and least delicate part of its skin. The **hair** at birth varies in amount. Sometimes it is scanty, sometimes long and dense. Often the first hair will be replaced ere long by a shorter and thinner growth.

We have not here space to discuss the internal anatomy of the infant. It presents many points of interest—as, for instance, the large size of the **Thymus gland,** which lies behind the upper part of the breast bone, reaches slightly into the neck, and measures from 1·6 to 2 inches from above downwards. It remains large for two years, and then begins to atrophy. The process of atrophy is usually completed by the ninth or tenth year. Again, the **liver** of the infant is relatively very large, and occupies nearly half the abdominal cavity. The **bladder** in children lies much higher than in adults, and is more directly under the control of the abdominal walls. This accounts for the vigorous expulsive powers which little boys display. The position of the bladder is of great importance in surgery. But we must refer the professional reader to more detailed works on the subject.*

ESTABLISHMENT OF FUNCTIONS.

Respiration.—The child usually begins to breathe spontaneously as soon as it is born. Up to the moment when the navel-string is tied, or the after-birth is detached from the womb, it lives without breathing. At this time it must begin to breathe or die. The principal causes of death of the child during labour are such pressure on the cord as stops the circulation before the

* See especially a valuable work by Ballantyne, *Introduction to the Diseases of Infancy.* This book, which is illustrated by frozen sections, &c., contains much information and good original work.

child is born, or else such injury to the head that the nerve-centre for breathing cannot act. Truly, at the moment of birth life seems to hang by a marvellously slender thread, but in an uninjured child who is duly cared for, the lungs will assume this function with a wonderful degree of certainty. The cause of the beginning of breathing is, first, the need of air. Throughout life, nothing excites more violent efforts to breathe than venous blood acting on the breathing centre. Secondly, the sudden exposure of the warm skin to the cold air, which is perhaps 40° colder than the interior of the womb—the involuntary gasp caused in the adult by a cold douche to the spine illustrates the power of this stimulus. Thirdly, the sudden liberation of the child's body from pressure helps the chest to expand and draw the first breath. A vigorous cry is the usual sign of established respiration, and the strength of the cry is a good index of the child's vitality (see Chapter iv.). When the breathing is established, what are its *rate and characters?* The rate varies, and is easily disturbed by slight causes.

The average at birth is about 44 per minute.
,, in the early months, 35 to 40 per minute.
,, at the end of the first year, 28 per minute.
,, in the third and fourth year, 25 per minute.
,, in the adult, 16 to 18 per minute.

Respiration is, as a rule, slower during sleep in infancy. Parrot found it to be slightly more frequent in 34 cases of new-born children observed by him,* but the rule is as here stated.

The breathing of infants is "abdominal" in type, that is to say, the rise and fall of the front of the abdomen is relatively more marked, and the rise and fall of the chest-wall relatively less marked, than in the adult, and so also the sides of the chest expand very little in the infant. As the child breathes the respiration should be quiet, and especially should the inspiration be noiseless. A noise on drawing in the breath points to spasm or obstruction in the larynx. The nostrils should not markedly dilate, and as the child draws its breath there should be no sinking in above the breast bone, or at the pit of the stomach, or at the sides of the chest.

It is a very good thing for a nurse to observe the rate and characters of the breathing of each individual infant. Fever quickens the breathing, so does any lung affection—*e.g.*,

* Vierordt in Gerhardt's *Handbuch der Kinderkrankheiten*, vol. i., 2nd edition, 1881.

bronchitis. When a child has bronchitis, one can often judge whether it is better or worse by noting how the rate of breathing alters. Infants do not expectorate. Any phlegm that rises from the lungs is swallowed. It may sometimes be vomited subsequently, as in whooping-cough. Children ought to breathe through their nose without a constant snuffling noise, and without any obstruction.

Circulation.—Important changes take place in the circulation at birth, which are described in every work on physiology. The principal one is the closure of the oval aperture between the two auricles of the heart.* The sign that this has failed to take place properly is, that after breathing is established, there is blueness of the face and especially of the lips, also of the hands and feet, seen best in the finger nails. This may be soon rectified spontaneously. But occasionally the closure does not take place, and the blueness of face and limbs remains as a permanent feature, constituting what is called *Morbus Cæruleus* or the *Blue Disease.* Some other varieties of congenital defect may produce the same condition. Such children are very seriously handicapped. Most of them will not survive more than a few months, or years. They are very likely to succumb to any disease which may attack them, and are especially liable to bronchitis. There is no cure for the condition, but special precautions may help to prolong their life. For example, they need warmth, and a mild equable climate, and must be kept in a uniform temperature and warmly clothed. The diet must be simple and well regulated, and they must be prevented from over exertion and from excitement. Over-heated and ill-ventilated rooms must be avoided. Gentle exercise and massage may be recommended.

One of the symptoms of this condition is clubbing of the finger ends, but this may also be seen in lung disease.

The pulse in children is much more variable than in adults, and its rate is easily altered. Crying, for instance, may send it up ten or twenty beats, and sucking also will accelerate it. It is not easily felt at the child's wrist, and the nurse will do better to count the heart beats. Estimates of the average frequency of the pulse in infancy vary; we may take the average at birth to be about 130, but a pulse of 150 could not be called abnormal.

* Obliteration of the foramen ovale. This is said to close at birth. This means that the passage through it of blood ceases. As a matter of fact absolute closure is delayed for months or even years, but though there is potentially a small passage during this period, the admixture of venous and arterial blood ceases at birth. Da Costa Alvarenga, *Gaz. Méd. de Paris,* 1870, p. 104. Parrot, *Clinique des Nouveau-nés. Athrepsie,* p. 14.

It is faster in girls than boys; during the first month it will range from 120 to 140. Trousseau gives the average for the first two months as 137. From the second to the sixth month, 128, from the sixth to the twelfth, 120, and from the twelfth to the twenty-first, 118.

In the second year the pulse will average about 110, and in the third year it will be between 90 and 100, and will continue at this rate until the sixth year.

Owing to the variability of the pulse, the respiration and temperature also must be taken into consideration before a reliable conclusion can be reached.

The temperature of a child is a point of great importance, as an infant cannot describe its symptoms; and as much experience is needed to estimate the value of various objective signs, it is of much value to nurses and parents to be able to use the clinical thermometer for exact observation.

Rules for taking an Infant's Temperature.

1. Shake down the thermometer index till it marks between 96 and 97.
2. Oil the bulb, and placing the child on its side, gently pass the thermometer bulb 2 inches within the bowel. Then hold the instrument and the child steadily for five minutes.
3. Remove thermometer, read the temperature, and record it at once in writing; the best plan being to record it on a chart.*
4. Wash instrument carefully, but not in hot water, and disinfect it. The thermomcter may also be held in the mouth. The axilla and the groin are also available. They will give a temperature from ½° to 1° below the mouth or rectum, but unless the observer can be sure that the bulb is thoroughly in contact at all points with the skin, the observation will not be reliable.

The rectal temperature at birth is 100° F. Then it falls in a few minutes about 3°. It may fall lower if the child is weak and feeble, and much lower if the function of breathing is delayed or insufficiently established. In a few hours it will be from 98·8 to 99, which may be taken as the normal standard. The temperature will vary during the day. It is lowest in the small hours of the morning, and highest at about six in the evening. The range of variation has been found to be about 2° F. (*Finlayson*), 1·2° F. (*Sturges*).

Now, it may be granted that amongst the wonders of physiology is the power which the human body shows of regulating its heat, and of maintaining an almost uniform temperature from

* The writer has designed a special short-interval clinical chart, suitable for recording temperatures every three, six, twelve, or twenty-four hours, which can be obtained from Messrs. Reynolds & Branson, of Leeds.

mid summer to mid winter, and from the poles to the tropics. But it must be clearly understood that in infancy the temperature is more easily disturbed than in the adult. **Children easily lose heat from the skin**; they cannot stand the exposure of large tracts of skin to cold air, and they soon take cold. To the premature and weakly infant loss of heat from the skin is specially fatal, and in the healthiest child the clothing must be adapted to prevent undue heat-loss.

The heavy infant mortality from disease of the respiratory organs is really an object lesson on this subject (see Chapter ii.). In old age there is a similar difficulty in maintaining the heat of the body. Again, the temperature in infancy is easily elevated. From a given cause it will rise much higher in the infant than in the adult. Hence a sudden **elevation of temperature** in childhood is of itself far less alarming than in later life. To guide the nurse's judgment we may say that if the thermometer reads below 98, it may mean that the child's vitality is depressed, but it is more likely that the temperature has not been properly taken. Try again, putting the bulb in the rectum. If it reads from 99 to 100·5 the child is somewhat feverish. If from 100·5 to 102 there is decided fever. If from 102 to 104 the fever is very high, but in itself not alarming if it comes down soon. If above 104 anxiety must be felt, but temperatures of 105 are often seen at the onset of specific fevers in infancy. Above 106, dangerous and fatal conditions must be feared unless there is a very speedy fall, and 107 is most exceptionally high, and the case grave in the extreme. Before giving way to alarm, make quite sure that the index was actually shaken down before the instrument was used. We have seen some extraordinary temperatures recorded by thermometers which had been accidentally heated on a hot surface.

The Fæces.—The first motions in a new-born child are different from those passed at any subsequent time. Before the child is born, and while it is still nourished only through its mother's blood, its intestines fill up with a dark brownish-green or nearly black fluid, which is called **Meconium**. This begins to accumulate two or three months before birth, and consists of materials from the bile, of mucus and scales from the bowel coat, but, of course, it cannot contain any remnants of food from the stomach. It is a matter of interest to know that it contains no Bacteria,* so that it is not septic or liable to cause blood poison-

* Escherich, *Zeits. für Geburtskunde.* Quoted in Booker's article on "Miero-organism in the Intestines," in vol. iii. of Keating's *Cyclopædia of the Diseases of Children.*

ing. The amount of meconium is estimated by Depaul to vary from 30 to 127 grammes, giving an average of 74 grammes (2·6 ozs.) Most of this will pass away in the first twelve hours, but the evacuation will not be completed for three or four days. Hence, the dark and peculiar appearance of the first motions of an infant must be regarded as a healthy and normal sign. But an ignorant nurse often declares that it is necessary to give a purgative to clear away this meconium, and hence, before the unfortunate child has been an hour in the world, it receives a dose of castor oil, a dose which will be repeated subsequently on the slightest pretext, for this drug is a popular cure-all for the ills of infancy and childhood.

In three or four days the *stools* of the child will become bright yellow, uniform in consistence, and like thick soup, and almost without smell. At first there should be two to four motions daily, later one or two. If there are many more than this, if they are green and offensive, or if they are pale and putty like, or filled with curd and undigested milk, the stools are unhealthy; still more so if they contain slime and blood.

The first milk which comes in the breasts after labour is slightly purgative in its action. It is called **Colostrum**. Tarnier says that it makes the stools of less consistence and gives them a greenish colour, which may last for some time, so that the natural yellow colour is seen earlier when the child is suckled by a wet-nurse than when its own mother gives it the breast.* Bouchand says that the weight of fæces evacuated daily by an infant at the breast is about 80 grammes (or 2·8 ozs.), whilst the average for an adult is 170 grammes (5·9 ozs.) The fact that an infant swallows so much and absorbs so little accounts for the above relatively high proportion.† Towards the end of the second year the motions should be formed, and have a colour and odour approaching to what is observed in adults.

The Urine.—It is not easy to say much which is of practical utility concerning the urine of infancy. Urine should be passed within a few hours of birth; after this the child will pass it at frequent intervals into the diapers, and it is no easy matter to collect the urine for examination. It should not stain linen, and should have very little odour. Its specific gravity is low. Its reaction is slightly acid or neutral. It contains no sugar, and should not contain albumen. Albuminuria in an infant must be regarded as a sign of disordered function. The quantity passed is small in the first three days. Parrot and A. Robin

* *Allaitement et Hygiène des enfants nouveau-nés*, p. 31.
† *Ib.*, p. 33.

estimate that from the sixth to the thirtieth day the amount passed is $5\frac{1}{4}$ to $10\frac{1}{2}$ fluid ounces. During the first year it rises from 14 to $17\frac{1}{2}$ fluid ounces. In the second year it varies from $17\frac{1}{2}$ fluid ounces to a pint or more. Relatively an infant passes more than an adult; but then an infant lives on fluid food.

The principal question for a nurse is, when will the infant acquire voluntary control over its bladder?

There is great difference between children. From six months onwards the nurse may notice an increase in the number of hours that the child keeps dry, but the final cessation of incontinence by night or day may be indefinitely postponed even after infancy is over. But in this matter regular feeding and regular holding out will do much to bring about early cleanliness of habit.

The function of **suction** is performed instinctively from the first. On consideration it will be seen that this is one of the most important of all the functions of the infant. It is performed by the action of the tongue in the mouth. The lips close around the nipple, the soft palate and pharynx close the mouth behind, the jaw is depressed, and the tongue is drawn backwards and downwards. The tongue thus acts like a piston. A vacuum is formed in the cavity of the mouth, so that the atmospheric pressure tends to make the cheeks fall in slightly, and in the same way the milk is forced into the mouth. When the mouth is full the contents are swallowed, and the process is repeated. Sucking is interfered with by hare-lip and by cleft palate.

To what extent is the power of sucking interfered with by *tongue-tie*, or undue shortness of the bridle of mucous membrane beneath the tongue? Old-fashioned nurses find a great proportion of infants to be tongue-tied. Recent authorities declare that even if the bridle is short it never causes any harm, and that it is useless to divide it.* We believe that the truth lies between these extremes. Rarely is shortness of the *frænum linguæ* of importance; occasionally it may be divided with advantage. A surgeon must perform this little operation, for serious hæmorrhage might follow if certain blood-vessels were divided. Possibly a certain degree of tongue-tie may interfere at a later period with the acquirement of the power of correctly articulating certain consonants and sounds, as, for instance, the r-trill.†

* Tarnier, Chantreuil, and Budin, *Op. cit.*, p. 185.

† The author will publish shortly, in the *American Journal of the Medical Sciences*, a paper on "Defective Articulation of the Consonant R," to which subject he is anxious to call attention.

The easiest way to expose the *frænum linguæ* for observation and treatment, is to compress the child's nostrils, when it will at once open its mouth and cry, putting the tongue on the stretch.

The **Saliva** in infants is at first of very small amount, especially in the first two months. It becomes more abundant when teething begins. Now the chief function of saliva in the adult is to help the digestion of starch by turning it into grape sugar. In infants not only is the saliva scanty, but its starch-digesting power is, though not absent, slight and inadequate. Hence follows a most important principle for infant feeding, viz., that **starchy foods cannot be properly digested in early infancy.** There is only too much evidence of the ill effects of neglecting this principle. And we may add, that the secretion of the pancreas, which in the adult has powerful starch-digesting power, shows also a marked deficiency of that power in infancy. On this ground we must further emphasise the principle just laid down.

The **stomach** of an infant is of *small capacity*. At birth it will contain only about two tablespoonfuls; at the end of a month it will hold five tablespoonfuls; at the end of two months, 3 fluid ounces and 1 or 2 drachms. After this it increases in capacity more slowly. At five months the capacity is about 4 ounces, at seven months about 5 ounces, at twelve months 7 ounces, and at the fourteenth or fifteenth month the stomach will hold about half a pint. Some authors give a higher estimate. Hence the stomach of an infant is soon full. When it is overfull it easily relieves itself by rejecting its contents. In consequence of this a certain amount of vomiting is natural to an infant, as natural as crying.*

The muscular movements of the stomach walls are also feeble at this age.

On the Digestion of Milk.—When milk enters the stomach it rapidly becomes *curdled* by the action of the gastric juice, and, if the infant should vomit the contents, abundant, soft flocculent curd will be seen. The infant's stomach is said to curdle the milk more rapidly than that of the adult. It will be remembered that in the dairy cheese is made by employing the "rennet" of an animal's stomach to turn the milk into curds and whey. This is in principle the same process which we have just described as the first stage in milk digestion.

The second stage is the *peptonising* of the curd. This implies dissolving it and changing it into a form that can be easily

* "First there's the infant, mewling and puking in its nurse's arm"—*i.e.*, wailing and vomiting.

absorbed by the coats of the bowel, and it is accomplished by the gastric juice by virtue of the pepsin which it contains. By the time the milk leaves the stomach it is converted into a creamy acid chyme. And the peptonising process goes on best when the milk is well diluted with water, and when the milk has been boiled (*Reichmann*).

It will be seen hereafter that certain classes of artificial foods for infants are prepared by imitating the starch-converting power of the saliva, and also by reproducing outside the stomach the peptonising action of the gastric juice.

During digestion lactic and hydrochloric acids are poured out into the stomach, and this is why hydrochloric acid has been sometimes used for artificial digestion.

Useful as such artificial foods are, it is by far the best thing for the digestive organs to do their own work, if possible. In the intestines the above processes are continued and completed. The peptonising is accomplished very thoroughly, the pancreatic and intestinal juice assisting, and the peptones are easily absorbed. The starch transformation is completed by the pancreatic and intestinal juice, and, perhaps, to some extent by the bile. The fatty materials are emulsified and made easy of absorption by the action of the bile and the pancreatic juice. There is plenty of bile in infancy, and infants take cream and other fatty materials very well. Young children will often drink cod-liver oil from the bottle neck, and ask for more.

The reasons why *infants cannot take meat and other solid food* are these :—

They are without teeth, and these are necessary to accomplish the first stage in the digestion of solid food, which consists in grinding it to a pulp. The walls of the stomach and intestines are weak, and are not equal to the vigorous movements required for the propulsion of the more solid contents. The digestive juices are at first scanty in quantity, and feeble in action, as far as the digestion of solid is concerned. It does not follow from this that infants cannot digest the juice of meat; on the contrary, this can sometimes be administered with great advantage, as we shall show hereafter.

Weeping. — At first infants cry without shedding tears. Darwin has published some observations on this point. In one case, tears first ran down the cheek on the 139th day. In another, the eyes were slightly suffused at 20 days. In others at 62 days, 84 days, 110 days, 42 days respectively. Hence the date of the first weeping is variable.*

* *Expression of Emotions in Men and Animals*, chap. vi.

Perspiration.—There is not much perspiration at first from the skin. This function gradually becomes established after a few weeks. Nevertheless, infants may perspire when too much wrapped up. In rickets, perspiration from the head is a very prominent symptom, and when there is lung disease and imperfect oxygenation of the blood, the sweat is often copious.

In the **breasts** of new-born children a curious phenomenon is sometimes noticed. These glands contain milky fluid, and this occurs as often in males as in females. The Germans call it *Hexenmilch* or witch's milk. It appears from four to ten days after birth, and it may continue for four or five weeks. By most authorities it is held to be a true lacteal secretion—*i.e.*, real milk. Sometimes an abscess forms in these milky breasts. Many ignorant nurses deliberately squeeze the infant's breasts daily to get the milk out. This treatment will very likely cause inflammation and abscess, and when the abscess is healed the nipple may become retracted, and in after life be practically useless for suckling.*

If the breasts are not much swollen and not reddened, they are best left alone, being protected by a pad of cotton wool secured with strips of plaster. If they seem inflamed they need fomentation or belladonna plaster. If an abscess forms this must be treated surgically.

THE BONY SYSTEM.

Few features in the development of the child are more interesting or more important than the formation of its bones. At birth there is not a fully solidified bone in the body. The skeleton may appear complete in form, but the bones composing it consist more of gristle or cartilage than of hard bony material: cartilage can be cut with the knife, which bone resists; cartilage can be bent, bone is firm.

In a healthy child, placed in healthy surroundings, and fed on proper food, the bone-formation, or ossification, advances rapidly in the skeleton; but under adverse conditions bone-making may progress slowly and imperfectly. The skeleton may become deformed, especially in the limbs and chest, and when the ossification is complete the child may be permanently disfigured by bent limbs, misshapen chest, and other deformities. To this most important subject we shall return when we speak of rickets (see p. 42). We will in this place only speak of the normal

* Winckel, *Lehrbuch d. Geburtshülfe*, says that Mastitis neonatorum is almost certainly due to entrance of germs, perhaps from the vagina.

development of the bones. Ossification starts in the cartilaginous bone at one or more points, which are hence called centres of ossification, and the separate portions of bone thus developed are ultimately all blended together, and then the bone is complete; but many of the bones are not finally solidified until adult age. The separately formed portions of bony tissue found at the extremities of the bones (see Fig. 1) are called *epiphyses*. It is chiefly at the epiphyses that a bone increases in length. When, in rickets, the ends of the bone above the joint are swollen, it is

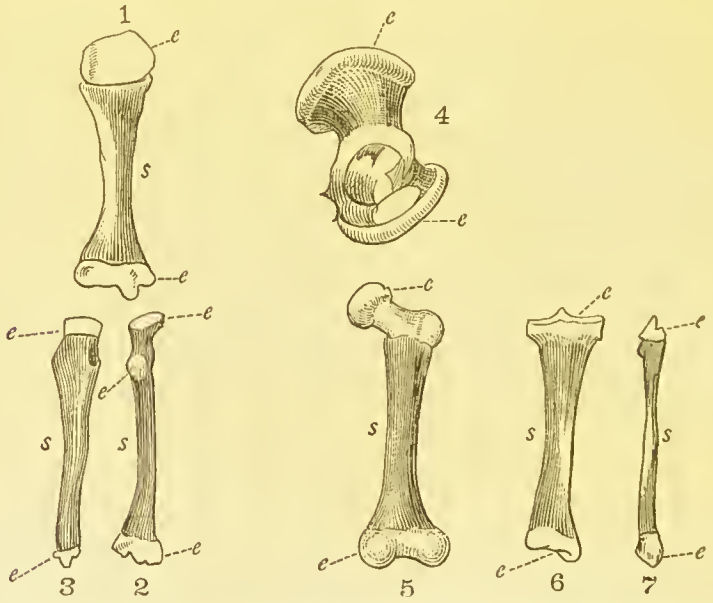

Fig. 1.—Sketch of bones of extremities at birth, showing epiphyses (after *Quain*).

1. Humerus.
2. Ulna.
3. Radius.

} Bones of arm.

4. Hip-bone.
5. Femur.
6. Tibia.
7. Fibula.

} Bones of leg.

s = shaft of bone. *e* = epiphysis.

the diseased epiphysis that causes this symptom. Violent injury may sometimes separate the epiphysis from the bone. Increase in stature chiefly depends upon the lengthening of the leg bones. After birth the legs grow more quickly than the arms.

The *skull* of the infant has special interest. At birth the bones lie edge to edge, but do not join; in fact, during birth the bones may slightly overlap at their edges. This facilitates birth, for a child with a rigid skull could hardly be born alive. At the

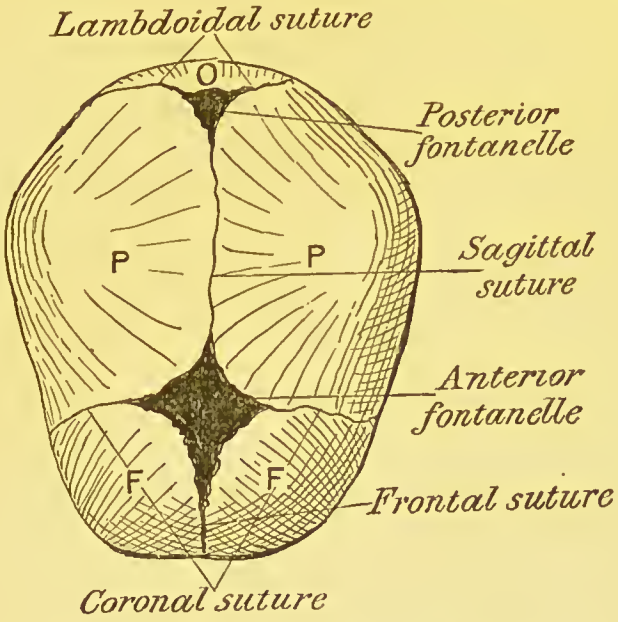

Fig. 2.—The skull of a new-born infant showing fontanelles, seen from above. O, occipital bone; P P, parietal bones; F F, frontal bones (after *Donald*).

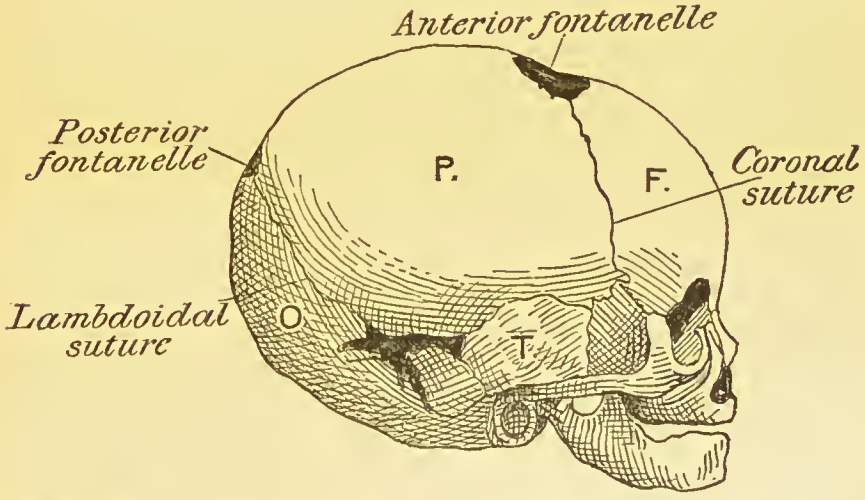

Fig. 3.—The skull of a new-born infant showing fontanelles, side view. O, occipital bone; P P, parietal bones; F F, frontal bones; T, temporal bone (after *Donald*).

top of the head of the new-born child a lozenge-shaped gap is left between the corners of four bones which meet there (see Fig. 2). This is called the *fontanelle.* Here the pulsations of the brain can be felt. In from eighteen months to two years this fontanelle will disappear, but in rickety children it may remain widely gaping long after it should be closed. The condition of the fontanelle should be noticed. It should not be unduly tense, nor throbbing with fever heat, and it should not be sunken in.

There is a smaller triangular fontanelle at the back of the head, and others at the temples, but these will cease to be perceptible soon after birth.

THE NERVOUS SYSTEM.

The new-born child can breathe and cry, its heart beats, it can suck and swallow, the bowels and bladder can empty themselves. The child can move the limbs and can cling with the hands. It can do little more than this, and its consciousness is almost a blank. We have to watch the acquirement of strength and of directed movement in the muscles, as also of the power to sit, to stand, and to walk; the development of the senses, the dawn of consciousness, and the acquirement of articulate speech, and the establishment of relations in general with the world around; the growth of intellectual faculty and of the moral sense. The complete history of the individual from the time of earliest development to the day when he is able to dispense with parental help and earn his living in the world, forms a subject unsurpassed in importance by any that can be presented to the mind of man. The destiny of the race is bound up in the solution of the problems which this subject presents.

Inherited tendencies for good or for evil lie ready to reveal themselves, and many of the questions connected with them seem insoluble. Even if we had an exact detail of a man's ancestry, it does not follow that we could predict the character of the individual. We never know which ancestral traits will present themselves. No one has yet explained the difference seen between various children of the same parents. We know that when a physical peculiarity runs in a family, as, for instance, a sixth finger or toe, if one individual shows it, his grandfather may have had it, but not his parents; one or two cousins may have the extra digit, but none of his brothers or sisters. In like manner, mental characteristics appear irregularly and unaccountably. A law there must be, but who can lay it down?

One of O. W. Holmes's characters says that every man is an omnibus carrying his ancestors inside. To this one might add that there is no telling which ancestor will show himself next, or what feature he will present.

The development in childhood of the *functions of the brain* and nervous system, seems likely to attract more and more attention.

We can only treat very briefly of the question in these pages, but for further information the reader may be referred to the works of Perez, Preyer, and others (see p. 23).

It has usually been considered that the *nervous system* in infancy and childhood is specially sensitive and irritable.

It is well known, for instance, that convulsions are more common in infancy than in adult age, and that they can be excited by slight causes, such as indigestion or the prick of a pin, or by a rise of temperature which in an adult would only produce a shiver. It is a fact also that children are specially liable to certain spasmodic diseases—*e.g.*, spasmodic croup. It seems likely, however, that this irritability of the nervous system is not developed in early infancy, but somewhat later, especially towards the time of teething; moreover, a very great tendency to spasm and convulsion is a sign of an unhealthy constitution, and is especially associated with rickets.

MOTOR FUNCTIONS.

Various classes of movement are performed by the body. First, there are automatic movements which need no consciousness to start them, and no teaching or practice to acquire them. Such are the beating of the heart and the movements of breathing. Closely allied to these are various reflex movements, in which muscular contraction is due to some distinct stimulus —*e.g.*, sneezing, hiccoughing, the last part of swallowing, the evacuation of the bowels and bladder.

Then there are certain instinctive movements, such as are seen so well in animals. Take, as an instance, the newly-fledged chicken, who will pick up a grain while the remnants of the egg shell are still sticking to its tail. In infants the power to suck is an example of instinct, chewing is another. The early movements of the limbs, and the crying of the new born are automatic. Later on, consciousness and volition take the control of these actions, but at first they are unconscious and involuntary. Last of all we see the highest motor function, namely, conscious voluntary movement, as, for instance, when the child pushes away the bottle which it will not have.

The *movements of the limbs* commence before birth; and as soon as the child is born, more or less active movements of the limbs can be seen. At the end of two months these have considerable vigour, and the child evidently derives pleasure from executing them. The movements of the head are feeble at first. The child smiles first when the cheeks are touched, but this is chiefly reflex; but at the end of two months it may smile constantly when pleased. At the end of three months the motions of the hands are more distinct and better directed, and the infant can take hold of things and put them to his mouth. Soon after the third month the head can be raised, and at the fourth month the child may begin to have some power to retain the sitting posture. At six months it will usually be able to sit up and use playthings; at eight months it may be able to creep; at nine to ten months it is making efforts to stand; at eleven months it can often walk with assistance; at twelve months it can stand alone; and at fourteen or fifteen months walk alone. At this age it has much control over the hands, and turns the ear readily at every sound.

We may refer here to some recent observations on the *power of grip* in new born infants.

As the result of observations made on upwards of sixty infants it was found by Dr. Louis Robinson that almost all could, within an hour of their birth, support the whole weight of their body for ten or more seconds by clinging to a finger or a stick, and that at the age of two or three weeks children could be got to hang by their hands for periods of one and a-half and two minutes or more. In one case the time was two minutes and thirty-five seconds. Dr. Robinson traces the origin of this to the days of our tree-inhabiting progenitors, when the survival of the offspring would depend on its power of clinging to its mother as she escaped from her enemies through the branches of the forest.*

SENSORY FUNCTIONS.

Perez concludes that a child may know pleasure and pain before it is born. This is based upon the fact that the brain and nerves seem sufficiently developed for the purpose. Moreover, a seven-months child can show so much evidence of sensation before it is two months old that one is led to consider whether it would have been devoid of all consciousness had it remained for two months longer within the womb.

* "Darwinism in the Nursery," by Louis Robinson, M.D. *Nineteenth Century Magazine*, November, 1891.

At any rate, the ordinary sensation in the skin is present from birth.

SPECIAL SENSES.

Hearing.—Infants are said to be born deaf, but they soon show sensitiveness to loud shrill sounds, and may show distinct pleasure at musical sounds when one or two months old. At six months most babies like to be sung to. Children like to make noises, and delight in rattling and jingling sounds, as also in shrill whistles, which are torture to adults, whose ears are more sensitive. To the school-boy a new noise is a new joy, whether produced with pencil and slate, jew's harp, "popped" paper bag, comb and tissue paper, feet, fingers, or lips.

Taste.—Probably this sense is active almost from birth, the child deriving one of its earliest pleasures from the taste of its mother's milk. Certainly a hand-fed infant may early show relish or dislike for certain kinds of food.

Smell.—The power of smell is probably not very marked at first, and accurate discrimination of odour is a late acquirement. This is a point on which it is very difficult to obtain reliable information.

Sight.—The power of vision is a complicated acquirement. It involves not only the distinction between light and dark, but also the recognition of colour, the proper movements and co-ordination of the eyeballs, the focussing of the eye, and the correct judgment of form and distance. Consequently it takes a long time to learn to see.

At first there is a diffused sense of light. The infant is soon attracted by anything luminous or bright, such as a candle, or a flashing pair of spectacles. For two months the eyes may not move together properly, so that there may be some squinting. Judgment of distance is at first obviously imperfect, and the child will try to grasp far-distant bright objects. In six months it may begin to recognise people around it. Power of distinguishing colour is a comparatively late aquirement; red and yellow may be recognised in the first year of life, green and blue in the second or third. This is very interesting, because colour-perception seems to be one of mankind's latest visual acquirements, and some individuals remain permanently more or less colour-blind.

How do Children learn to Speak?—The first cries are instinctive, and are made with little or no consciousness. Presently the child finds that a cry brings relief to its wants, and it gradually learns to give a cry for this purpose. This is

the beginning of its language. The quality of the cry will vary with the strength of the infant and the conformation of its vocal organs. Secondly, children learn to speak by imitation. This is the main factor by which they come to talk the language of their parents. There is, however, another factor at work, namely, heredity. How far this acts, it is difficult to estimate; but it is pretty certain that a child has some untaught ability which helps it to speak. Gestures can be transmitted; the style of hand-writing can be inherited, why not also some part of the speech-faculty? Children, then, begin to express themselves by attaching a meaning to noises and gestures which they have already been making involuntarily and unconsciously. They find out that these mean something, and can be used to express their wants and feelings. By the time they are twelve months old they will usually know the meaning of several words, and there will be one or more articulate sounds which they are commencing to use intelligently. Darwin's child when a year old tried to invent a word to designate his food and produced the word "mum," and henceforth that syllable signified "Give me something to eat." The first vowel sound learned is the open "ah," and the first consonants the labials "m," "p," and "b," &c. Hence "mama," "papa," and "baba" are often the first words spoken. After this the child quickly acquires a variety of words, and by the end of the second year he is beginning to use phrases. But some healthy children are late in speaking, and may be several months behind the usual standard, and yet may ultimately speak with all correctness. Perez says that slowness in learning is not a bad sign, and that children may, like the celebrated parrot, "talk little, but think the more." Meaningless reiteration of sounds is no sign of a weak brain.

The development of the intellectual faculties and of the moral sense is a study whose interest and importance one can hardly over estimate. The dawn of intellect is seen in the first voluntary and conscious movements, in the earliest recognition of objects and faces, and especially in the development of speech. Before a child is a year old various emotions can be recognised, such as, anger, fear, love, vanity, and jealousy; and strength of will-power can be clearly proved. The great importance of the subject centres in the problem of how far educational and disciplinary agencies can be brought to bear upon the infant in these early stages of development. Rudimentary the treatment must be, but early impressions are so persistent, that everything points to the desirability of investigating the subject. It is

plain that regularity of habit and obedience can be inculcated in the cradle. The infant can learn that he cannot have everything he cries for, and, as some early perception of right and wrong dawns in the child's mind, some effort can be made to lead him to choose between them from the first. There are various indications that this subject is beginning to receive more of the attention that it merits, and, perhaps, the best thing the writer can do is to avoid any common-places of his own on this question, and to refer the interested reader to certain important works bearing on this subject, as well as on the development of the intellect in infancy in general.

The first is Professor Preyer's work, *Die Seele des Kindes* (The mind of the child). This is translated by Mr. H. W. Brown, and published in two volumes in the *International Education Series*. To the second volume Mr. Brown has prefixed a valuable "conspectus" of Preyer's observations on the mind of the child up to the fortieth month of life. This will be of great service to the student. A second work is by Bernard Perez, *Les trois premières années de l'enfance* (The first three years of life), translated by A. M. Christie, with a valuable introduction by James Sully, M.A. (Sonnenschein & Co.). There is another work by the same author, *L'education dès le berceau* (Education from the cradle).

In the second volume of *Mind* (1887), Charles Darwin published an interesting account of the development of one of his own infants, and in the same volume, M. Paine gives an account of a child's acquirement of language.

Galton's "Life History Album."—We may take this opportunity of calling attention to a valuable publication. For the purpose of recording the history of individual lives from the cradle to the grave, the Collective Investigation Committee of the British Medical Association have issued, under the editorship of Mr. Francis Galton, F.R.S., a *Life History Album*. This is intended to be commenced by the parents and continued by the subject of the record on reaching mature years. The value of each record so taken is great, and when a large number of such albums are at the service of students of child-life and child-development, results of the highest interest and importance are likely to be obtained. The album contains directions for use, and shows the normal standards of growth and development throughout life. We strongly recommend the work to the reader's attention. It is published by Messrs. Macmillan & Co.

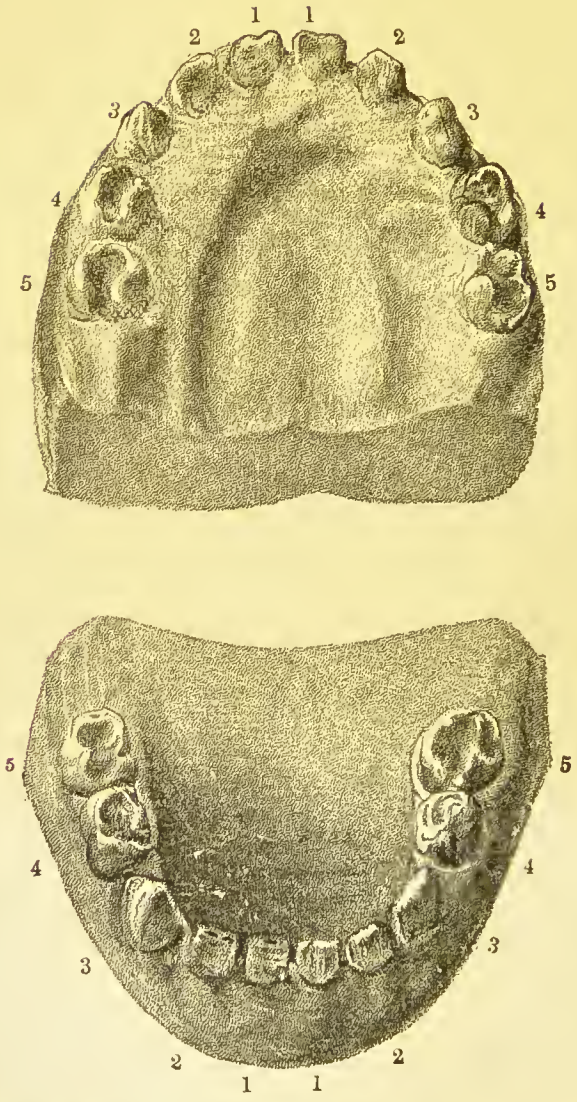

Fig. 4.—Diagram to show the deciduous teeth in both jaws, in position. 1, Central incisor; 2, lateral incisor; 3, canine tooth; 4, first præmolar; 5, second præmolar.

TEETHING.

The first set of teeth are called the *deciduous teeth*, because they are shed subsequently. They are also called the *milk teeth*, a term which conveys no precise meaning. The student may note the fact that the first set of teeth begin to appear in the sixth or seventh month, and the second set in the sixth or seventh year. The deciduous teeth are 20 in number, each half of each jaw containing 5—namely, 2 *incisors*, 1 *canine* tooth (also called the eye-tooth, from the erroneous notion that it has some intimate relation with the eye), and 2 *præmolars*. The diagram on p. 24 shows the shape and position of the deciduous

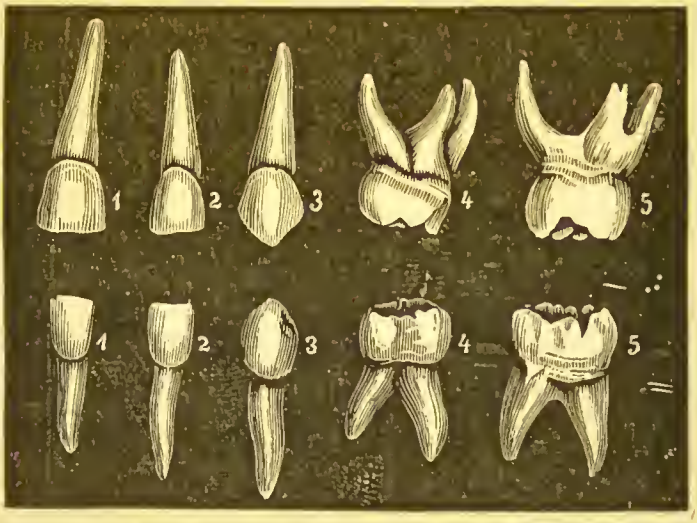

Fig. 5.—Diagram to show the individual teeth.
For references see Fig. 4.

teeth. It will be noticed that the lower central incisors are smaller than the upper (see Fig. 5), and that the upper præmolars have three fangs, whilst the lower have but two.

The number of teeth is sometimes expressed by a formula, thus :—

$$\text{Incisors } \frac{2-2}{2-2}, \text{ canines } \frac{1-1}{1-1}, \text{ præmolars } \frac{2-2}{2-2}.$$

The student will find such a formula useful in recording the number of teeth at any given age; for example, the following formula,

$$\text{I. } \frac{2-2}{2-2}, \qquad \text{c. } \frac{0}{0}, \qquad \text{p.m. } \frac{0-1}{0-0},$$

would express the fact that the child had all its incisor teeth, and one præmolar tooth on the left side of the upper jaw.

The order in which the deciduous teeth appear is thus described in Tarnier's work :—

> The milk teeth appear in groups, which are separated from each other by periods of rest.
>
> First come the two lower incisors, usually in the seventh or eighth month, but sometimes as early as the fourth.
>
> After an interval of six to eight weeks, the two upper central incisors appear, one eight to fifteen days after the other.
>
> Somewhat later come the two upper lateral incisors, so that the infant has now four teeth above and two below.
>
> About two months later—*i.e.*, at the commencement of the second year—the two lower lateral incisors, and the four first præmolars appear, their eruption being spread over about two months. Total, twelve teeth.
>
> Two months more pass, and then, at about the middle of the second year, the four canine teeth take their place between the incisors and the molars.
>
> After two months further interval—*i.e.*, towards the close of the second year—the four back teeth are cut, and the twenty deciduous teeth are complete.

The above may be taken as a general rule, to which there are various exceptions. There may be early eruption, and in rare cases an incisor may exist at birth. Again, the upper incisors may come before the lower, and even the lateral before the central. Supernumerary teeth may occasionally be found. The author has placed in the Museum of the Leeds Medical School a cast taken from a case in which there were six well-formed incisors in the upper jaw. Finally, dentition may be much delayed. This is seen in weakly, and especially in rickety children.

GROWTH IN WEIGHT AND STATURE.

There can be no doubt that systematic careful weighing and measurement of infant affords valuable indication as to the healthiness or otherwise of their constitution, of their food and their surroundings. This is especially true of weighing.

We particularly recommend the method of *recording weights graphically on charts*, in the same way that clinical temperatures are recorded. The author has recently designed a chart for making fifty-two weekly records in the year.* The advantage of such a record is very great, if regularly kept. The child should be weighed on a fixed day in each week, and at a fixed time. The time of the morning bath is recommended. The infant is wrapped in a piece of warm flannel of known weight, and placed

* They can be obtained from Messrs. Reynolds & Branson, of Leeds.

in the scale pan. Salter's family balance answers well for the purpose. It is a good thing if weekly records are kept till the end of teething; after that records may be taken at least monthly.

As an illustration of the value of such records, we give the following chart taken from observations made by Professor Bowditch, of the Harvard University, and given in Galton's *Life History Album.* The record extends over the greater part of a year in the life of a little girl. The chart shows a loss of weight corresponding to a period of impaired nutrition and glandular enlargements, and a regaining of weight under treatment. It also shows how the weight declined when measles was incubating,

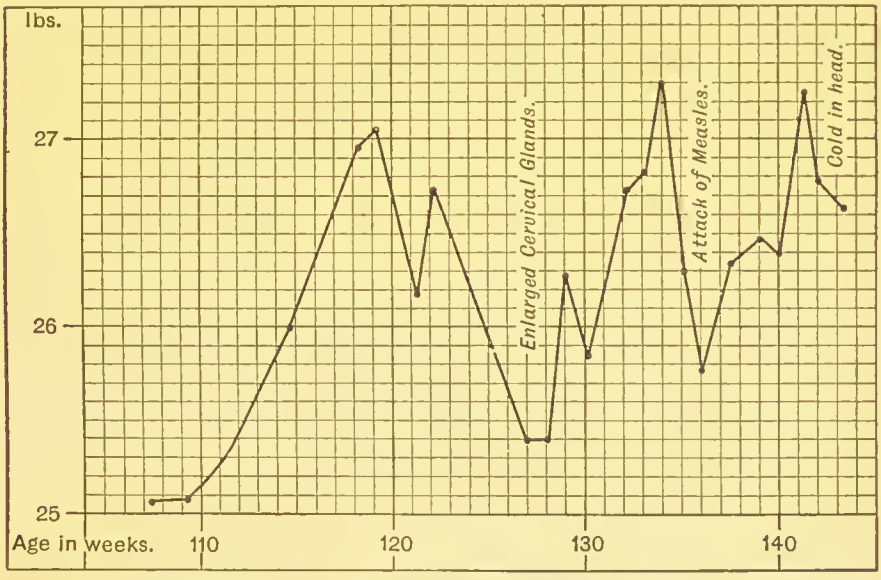

Fig. 6.—Curve of weekly weighings in a child in third year of life. (Given in Galton's *Life History Album.*)

and how the outbreak of this disease was thus heralded by a fall in the weight-curve. Such records are of special value in schools and families, for they are often of use in drawing attention to the morbid influence of some factor in the condition of health, whose early recognition may be of the greatest importance.

Standard of Increase in Weight.—It cannot be said that such a standard is finally established. The results obtained by different observers vary greatly, and this is due to the great variation that actually exists between different infants under different circumstances. Growth in weight varies with sex, with the initial weight of the child at birth, with the kind of feeding employed,

with the healthiness of the surroundings, with nationality, and with other circumstances.

We will now give some tables from various authorities. Fig. 7 shows in a graphic form the variation of weight observed in

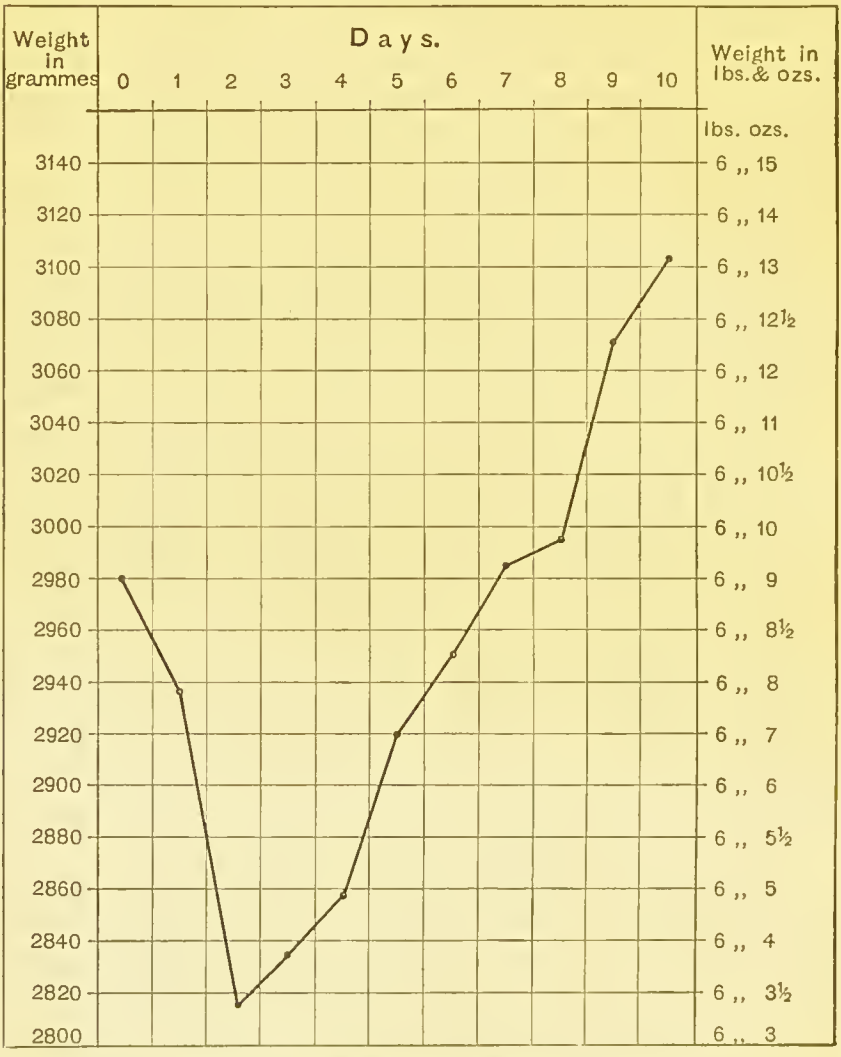

Fig. 7.—Chart to show variation in the weight of an infant in the first ten days of life.

one particular infant in the first ten days of life. This is taken from Tarnier, and illustrates the fact that the infant loses weight for the first three days, but regains its birth-weight at the end of the first week.

Fig. 8 shows in pounds and ounces the average growth in weight in the first year.

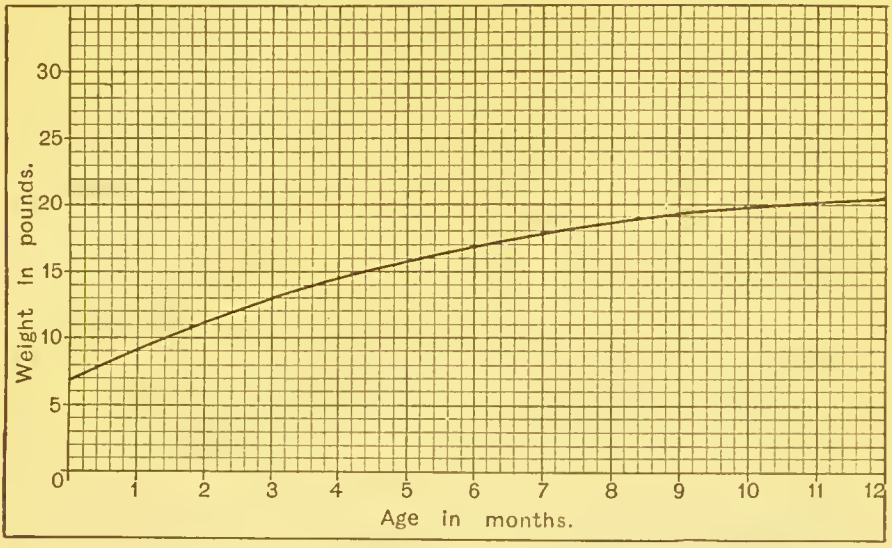

Fig. 8.—Graphic record showing the curve of weight in the first year of life.*

This figure is constructed from the following table, which has been converted from grammes to pounds and ounces :—

TABLE TO SHOW WEIGHT AT THE END OF EACH MONTH IN POUNDS AND OUNCES.

	Bowditch and Fleischmann.		Albrecht.		Biedert.		Mean.	
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
1.	9	5	9	0	8	14	9	1
2.	11	7	10	15	11	7	11	4
3.	13	4	12	13	13	7	13	3
4.	14	12	14	6	15	0	14	11
5.	15	15	15	12	16	1	15	15
6.	16	15	16	15	16	13	16	14
7.	17	12	17	14	17	8	17	11
8.	18	6	18	9	18	6	18	17
9.	19	1	19	5	19	3	19	3
10.	19	11	19	14	19	8	19	11
11.	20	3	20	7	19	13	20	2
12.	20	9	20	14	20	2	20	8

* The author is indebted to his friend, Prof. J. H. Goodman, for converting these tables, and drawing the weight curve.

The table assumes a weight at birth of 3,250 grammes, or 7·15 pounds.

It will be seen that the increase is much the most rapid at first. A child doubles its weight at the end of the fifth month, and trebles it by the end of the first year. But hand-fed babies do not treble their weight (says Russow) till the second year. During the second year the gain is about 5 pounds, and for the next six years about 4 pounds a year.

Growth in Stature.—The following Table is from Quetelet :—

Length at birth,			19·50 ins.
Growth in the course of the first month,	40 millimetres.		1·57 ,,
,, ,, second ,,	30	,,	1·18 ,,
,, ,, third ,,	20	,,	0·78 ,,
,, each following month,	10 to 15	,,	0·4 to 0·6 in.
Total increase, first year,	198	,,	about 8 ins.
,, second year,	90	,,	3½ ,,
,, third year,	73	,,	2·87 ,,
Each of two following years,	64	,,	about 2½ ,,

From this the following Table is deduced :—

Length at birth,	19½ to 20 ins.
,, at end of first month,	about 20½ ,,
,, ,, second ,,	,, 21 ,,
,, ,, third ,,	,, 22 ,,
,, ,, fourth ,,	,, 23 ,,
,, ,, fifth ,,	,, 23·5 ins.
,, ,, sixth ,,	,, 24 ,,
,, ,, seventh ,,	,, 24·5 ,,
,, ,, eighth ,,	,, 25 ,,
,, ,, ninth ,,	,, 25·5 ,,
,, ,, teuth ,,	,, 26 ,,
,, ,, eleventh ,,	,, 26·5 ,,
,, ,, twelfth ,,	,, 27 ,,
,, ,, two years,	,, 30·5 ,,
,, ,, three ,,	,, 33 ,,
,, ,, four ,,	,, 35·5 ,,
,, ,, five ,,	,, 38 ,,

A TWO-YEARS' DEVELOPMENT UNDER NORMAL CONDITIONS.

At the end of two years, then, the child should weigh 26 pounds, and measure 30 to 32 inches.

It should have twenty teeth. The fontanelles should be closed.

The child should be able to walk alone, the limbs being straight, the spine erect, and the chest well formed. No beads

should be present on the ribs, nor should any epiphyses be enlarged.

The heart-sounds should be healthy, the lungs should expand well, and there should be no wheezing or other abnormal sound in the chest.

The flesh should be firm, and the face healthy in colour. There should be no history of serious or continued diarrhœa and vomiting, no excessive sweating from the head, no tendency to bronchitis, croup, or convulsions, no undue protuberance of the abdomen, and no enlargement of the spleen.

The bowels should act regularly once or twice daily, the motions being pretty well formed, brownish in colour, and with a fæcal odour.

The child should have a good appetite for its food, should sleep well, and manifest great enjoyment of physical exercise.

It should be bright and lively, and be able to say several single words, and even a few phrases.

CHAPTER II.

ON THE DIFFICULTIES AND PROBLEMS OF INFANT-REARING.

In the last chapter we have sketched the normal development of an infant for two years. We will next inquire what proportion of new-born children are likely to survive this period, and what are the causes which tend to terminate their lives, or to injure their health and hinder their growth.

STATISTICS OF INFANT MORTALITY.

The *Report of the Registrar-General for* 1891 contains a valuable study of this question. In that year the death-rate for all ages was 20·2 in the thousand, but for children under one year it was 149 in the thousand, or 1 in 6·7. Remarkable evidence is also there given as to the excessive rate of infant mortality in densely populated manufacturing districts. We reproduce the following tables because the importance of the lesson which they teach cannot be over-estimated. They give a comparison of the death-rates in three rural counties, in five manufacturing and mining districts, and in three manufacturing towns which have an unenviable notoriety for their infant mortality:—

TABLE FROM REGISTRAR-GENERAL'S REPORT, 1891, p. 40.

Of 100,000 Persons, the Numbers Surviving at each Age.				Annual Death-rates per 1,000 Living in each Successive Interval of Age.		
Age.	Three Rural Counties—viz., Hertfordshire, Wiltshire, Dorsetshire.	Five Mining and Manufacturing Counties—viz., Staffordshire, Leicester, Lancashire, Yorks. (W.R.), Durham.	Preston, Leicester, Blackburn.	Three Rural Counties.	Five Mining and Manufacturing Counties.	Preston, Leicester, Blackburn.
At birth,	100,000	100,000	100,000	213	331	382
3 months,	94,820	92,051	90,874	75	154	240
6 ,,	93,068	88,574	85,574	61	128	180
12 ,,	90,283	83,081	78,197	...	...	...

As we study these figures, we are reminded of the saying that

"God made the country, and man made the town." *

If we next inquire what are the particular causes of the deaths above recorded, we find an answer in the tables on pp. 34 and 35, which are based on the observations of the three years 1889-91, being the first of the kind that have been constructed.

These tables show several points. Alike in town and country, the principal cause of death in the first week of life is premature birth, or some malformation, lung defect, or other cause which involves unfitness to live, and which leads to "Atrophy." More than four-fifths of the deaths in the first month are returned under these headings.

But, except in case of such birth-defects, the mortality is much in excess in towns.

We select from the tables the following conditions which are very largely due to causes connected with bad food, and add together the mortality assigned to them :—

	Three Rural Counties.	Three Worst Towns.
Diarrhœal diseases, ...	481	3,961
Enteritis, ...	122	497
Other diseases of the digestive organs, .	189	284
Tabes mesenterica, ...	216	577
	1,008	5,319

Here we see an enormous excess in urban mortality. Some of the cases called "atrophy" and "dentition" probably belong to this group. The deaths from "suffocation" are chiefly due to the smothering of children by overlying in the night; overlying chiefly occurs on Saturday night, a painfully suggestive fact. It is more common in town than country.

Syphilis is three and three-fifths times more common in the towns.

The comparative immunity of infants from epidemic disease is well seen from this report.

The term *rickets* does not occur in the above tables, but we

* Cowper, *The Task*. One might here quote, as still more appropriate, Cowley's line—

"God the first garden made, and the first city, Cain."

ANNUAL DEATHS, WITH AGES AND CAUSES, AMONG 100,000 INFANTS BORN ALIVE IN HERTFORDSHIRE, WILTSHIRE, AND DORSETSHIRE, 1889-91. (*Report of Registrar General*, 1891, p. xiv.)

CAUSES OF DEATH.	AGES BY WEEKS.				AGES BY MONTHS.												TOTAL.
	1st.	2nd.	3rd.	4th.	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	
Premature Birth,	1020	100	85	54	1267	54	19	17	10	2	2	2	2	2	2	2	1381
Atelectasis,	39	4	2	...	45	4	...	...	...	4	...	2	...	...	...	...	55
Congenital Malformations,	107	27	17	6	157	24	13	6	6	...	4	4	6	4	..	4	228
Whooping-Cough,	...	...	6	11	17	39	44	52	24	28	33	30	37	30	43	39	416
Measles,	...	...	...	...	...	...	...	4	2	7	7	22	39	28	24	43	176
Scarlet Fever,	...	...	...	...	...	...	...	...	2	...	...	...	2	...	...	2	6
Diarrhœal Diseases,	4	4	19	9	39	63	53	59	67	41	35	24	26	20	26	28	481
Enteritis,	6	2	11	2	21	11	11	7	14	11	6	9	13	6	6	7	122
Erysipelas,	...	...	7	2	9	6	6	2	2	2	2	...	...	...	...	2	31
Syphilis,	2	4	...	4	10	9	7	15	2	2	...	2	2	...	...	4	53
Liver Disease,	17	24	15	7	63	6	...	4	...	2	4	...	...	...	...	...	79
Dentition,	...	...	...	...	...	...	2	7	6	9	31	28	17	30	37	20	187
Other Diseases of Digestive Organs,	13	9	19	6	48	26	19	22	17	17	9	7	4	9	4	7	189
Convulsions and Diseases of Nervous System,	233	106	48	48	444	182	122	111	107	70	56	78	50	65	44	52	1381
Tubercular Meningitis,	...	...	2	2	4	2	6	9	9	9	19	2	19	28	11	20	138
Tabes Mesenterica,	...	2	2	...	4	19	22	28	22	20	20	13	15	17	19	17	216
Other Tubercular Diseases,	...	...	4	4	8	6	2	9	9	6	20	9	20	9	7	13	118
Atrophy,	579	101	160	108	968	220	141	89	96	50	46	41	24	26	22	15	1738
Diseases of Respiratory Organs,	22	46	39	44	168	247	170	188	185	145	163	184	154	181	182	138	2105
Injury at Birth,	7	2	...	...	9	...	...	...	...	...	...	...	...	...	...	...	9
Navel Hæmorrhage,	...	9	2	2	13	...	...	...	...	...	...	...	...	...	...	...	13
Suffocation,	14	8	2	10	34	15	24	10	12	6	4	2	4	...	2	...	113
Other violence,	33	3	2	...	38	...	...	3	...	2	5	...	...	2	2	2	54
All other causes,	67	22	20	13	122	52	46	31	26	28	17	24	20	19	24	19	428
ALL CAUSES,	2163	473	462	332	3488	985	707	673	618	461	483	483	454	476	455	434	9717

ANNUAL DEATHS, WITH AGES AND CAUSES, AMONG 100,000 INFANTS BORN ALIVE IN PRESTON, LEICESTER, AND BLACKBURN, 1889-91. (*Report of Registrar General*, 1891, p. xv).

CAUSES OF DEATH.	AGES BY WEEKS.				AGES BY MONTHS.												TOTAL.
	1st.	2nd.	3rd.	4th.	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	
Premature Birth,	1508	247	161	130	2054	158	25	19	8	6	6	...	...	...	...	3	2279
Atelectasis,	105	19	6	11	141	8	...	...	...	...	...	...	...	...	...	...	149
Congenital Malformations,	78	48	36	11	175	20	14	8	8	3	3	...	3	...	...	...	234
Whooping-Cough,	...	...	6	6	12	49	33	61	39	69	86	53	88	61	69	74	694
Measles,	...	...	...	...	...	14	6	11	19	19	33	50	111	133	130	100	626
Scarlet Fever,	...	...	...	...	...	...	...	...	3	...	3	8	...	8	6	3	31
Diarrhœal Diseases,	3	33	94	53	189	392	610	530	477	408	352	274	258	180	161	130	3961
Enteritis,	...	3	6	8	22	58	72	61	47	36	58	30	44	25	11	33	497
Erysipelas,	...	6	17	...	23	3	...	8	...	3	...	3	3	...	...	...	43
Syphilis,	3	3	14	3	23	39	44	25	19	11	6	6	8	6	3	...	190
Liver Disease,	11	19	19	3	52	16	6	6	6	...	...	...	3	...	...	...	89
Dentition,	...	...	...	...	...	...	...	8	25	53	39	53	50	80	80	36	424
Other Diseases of Digestive Organs,	17	11	14	14	56	25	30	28	44	28	11	22	14	14	6	6	284
Convulsions and Diseases of Nervous System,	435	156	165	136	901	380	391	391	302	308	289	186	200	176	130	122	3776
Tubercular Meningitis,	3	...	...	3	6	6	28	39	28	44	33	42	42	39	47	25	379
Tabes Mesenterica,	3	...	3	...	6	33	55	73	64	50	53	58	33	55	44	53	577
Other Tubercular Diseases,	...	3	...	...	3	17	33	25	25	39	22	11	25	19	25	17	261
Atrophy,	360	139	174	182	862	415	330	319	225	125	105	89	91	67	64	42	2734
Diseases of Respiratory Organs,	25	42	72	50	189	362	288	277	333	305	323	319	327	318	314	346	3701
Injury at Birth,	3	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	3
Navel Hæmorrhage,	...	5	3	3	11	3	...	...	...	...	...	...	...	...	...	...	14
Suffocation,	17	3	14	3	42	53	39	33	25	25	6	3	...	6	...	...	232
Other violence,	8	2	...	...	11	5	3	3	2	2	3	5	...	...	6	11	51
All other causes,	67	34	28	30	166	74	42	42	50	50	44	14	17	33	14	28	574
ALL CAUSES,	2646	773	832	646	4947	2130	2049	1967	1749	1584	1475	1226	1317	1220	1110	1029	21,803

know that it is a predisposing cause in a large proportion of the diseases mentioned. It is a factor in disease of the respiratory and digestive organs. It is a potent cause of fatal convulsions, and of "nervous diseases," and of diseases of "dentition," from all of which the greater mortality in towns is marked.

CAUSES OF INFANT MORTALITY.

We will now examine in some detail the causes of infant mortality, and as we do so we shall find the reasons why the mortality is so high in our large cities, and especially in our manufacturing towns.

Unhealthy Surroundings.—Amongst these we may mention **Want of Sufficient Fresh Air**, attributable to undue density of the population on a given area, or overcrowding within dwelling-houses; construction of blind alleys and courts, of back-to-back houses, and of narrow streets between very high buildings; absence of open spaces, and distance from any park or rural district; absence of provision for ventilation in dwelling-houses, and ignorance of the need of ventilation. To the inevitable stagnation and impurity of atmosphere thus produced we must add the direct fouling of the air by "middens," open sewers, bad drainage, accumulations of refuse and dirt, and by the products of offensive trades.

Want of Sunshine.—The sunshine is shut out by the ill-construction of houses, courts, and streets just referred to, and also by the clouds of smoke which overhang our manufacturing towns. This is no matter of mere conjecture. In the city of Leeds a series of observations on this point has been made by Mr. Richard Reynolds, by means of Jordan's sunshine recorder, and these have very clearly demonstrated the extent to which the sunshine is excluded from the heart of the city by the clouds of smoke which hang above it, which proceed both from factory and domestic chimneys. Children cannot thrive without sunshine any more than flowers can flourish without it. We know that sunlight can destroy disease germs, probably we do not yet know the full part which it plays in healthy growth, but at any rate we are beginning to realise the disastrous consequences of shutting it out.

Unsanitary Dwellings.—These may be ill-built, ill-ventilated, dark, ill-drained, and damp. Dampness causes rheumatism in children, and is known to be one great cause of chest disease. Its full action is not elucidated yet; very likely it helps to

provide breeding ground for disease germs, but without doubt, dampness of the dwelling-house is a serious factor in ill-health.

The Conditions of Life in Manufacturing Towns tend to cause infant mortality. The mothers work in the mills during their pregnancy. They often work very hard, and continue sometimes till the labour pains begin. The mills themselves are not always well ventilated. After the labour, the mothers often return to work in an incredibly short space of time. All this acts in more than one way. It damages the health of the pregnant woman, and therefore of her offspring. It interferes with suckling. The infants, being left to the care of neighbours or of older children, do not receive proper care, and suffer in particular from unscientific artificial feeding.

Early and Improvident Marriage has a direct bearing on this question. The parents often marry without adequate means, their very furniture being obtained on the hire system. To meet the expenses of the confinement and the infant's maintenance, the mother is obliged to work, and the mill or factory offers the best opportunity.

On the other hand, many mothers prefer factory life to home life. They find the former more exciting, and they neglect their children in consequence.

Poverty acts in a more deleterious way in town than in country. Fresh air, open space, and sunshine cost nothing in the country, and good milk is fairly cheap. In the towns the poor have to take the worst quarters, and the cost of good milk is greater. In fact, the cost of feeding a child properly is more than many parents can, or will, afford, and this fact is at the root of much of the improper feeding. Intemperance and immorality are more prevalent in large towns, and drunkenness and depravity in parents tend directly and indirectly to the production of diseased offspring. They act directly by the feebleness of constitution, or the actual disease transmitted to children; they act indirectly by the neglect which children experience from parents of this class, and by the poverty and general unhealthiness of environment which the habits of the parent entail.

Illegitimate Children have for similar reasons a comparatively high mortality.

Congenital Causes.—In inquiring why infants do not thrive we must remember that many come into the world with a distinct unfitness for living, being born prematurely, being puny, feeble, deformed, or diseased, or having some hereditary tendency to disease. We must remember that, as a rule, we are not born until we are nine months old, and in this most eventful period

morbid changes may occur which profoundly affect the whole after life. If there be any prevention for such conditions it must be found by dealing with the parents and with the conditions under which they live.* If we were writing on the rearing and the race improvement of any class of animals, except human beings, we should begin with the fundamental principle of breeding only from healthy parents. Those who were specially likely to transmit disease, those, for instance, who were the subjects of tubercular affections, persons with marked tendency to insanity, habitual drunkards, &c., would not be allowed to beget children. We should thus employ artificial selection to improve the species. Nature's plan is to select the fittest to survive, and let the weakest go to the wall. But the healing art knows and can know nothing of the sacrifice of the individual for the good of the race. On the contrary, all life must be cherished, and the weakest must be cherished most carefully.† This is all the more reason why the medical profession should seek, by advice and instruction, to educate public opinion on the quesion of the responsibilities involved in the reproduction of disease.‡

It may not be out of place to remark here that *mutilations* and *acquired deformities* are not transmitted at birth. A father who has lost a leg or an eye will produce children with normal eyes and feet. A mother's face may be seared by burns, or scarred with the pits of smallpox, but her infant will have a skin free from blemish. So the Chinese girl, after centuries of

* For information on the subject of diseases of the unborn child, we refer the student to a recent work by Dr. Ballantyne, on the *Diseases and Deformities of the Fœtus.*

† There is a popular notion that a seriously deformed or "monstrous" new-born child may be smothered. We need hardly say that any one privy to such an act would be guilty, probably of murder, certainly of manslaughter.

‡ For a valuable study of this and allied questions, see Professor Haycraft's Milroy lectures on "Darwinism and Race Progress," *Lancet*, February and March, 1894, from which we may quote the following sentences:—"The State now insists upon a parental regard for the external well-being of the child; may we not also insist that a parent is responsible for its innate well-being too. Once we have established such a point of view, once people have learned to look farther ahead and realise how much of the happiness of the future depends on their present action, I cannot but believe that this will affect their attitude in respect to marriage. Not only will the feeble and diseased realise the consequences of hereditary transmission and dread these consequences, but if they marry they will do so in face of public opinion, perhaps of public rule. Having aroused the public conscience on this subject, the sickly will with difficulty find mates, the sexual selection (marriage) will have more largely than at present the quality of the progeny in view."

foot-crushing, is born with feet as perfect as those of any other infant. If this were not the case, and if all the damages done to our ancestors left traces in their descendants, the battered, maimed, and mutilated state of men's bodies would long ago have led to the extinction of the race. But *debility of constitution* and *blood disease* can be both acquired and transmitted.

IMPROPER FEEDING.

It is extremely important to emphasise the fact that a very great proportion of the diseases of infancy are food-diseases—that is, they are due to food which is intrinsically unwholesome, or which is unsuitable or indigestible, or defective in nutritive properties.

Deleterious Consequences of Disusage of Suckling.—Any one who has experience of the children brought to our hospitals knows how often an infant's ailments date from the time of commencing artificial feeding, and to how great an extent the maladies of infancy predominate in frequency amongst hand-fed or bottle-fed children. The close connection between modes of feeding and infant mortality is shown by the fact that during the sufferings and starvation connected with the siege of Paris in 1870-71, whilst the general mortality was doubled, that of infants is said to have been reduced by about 40 per cent., owing to the mothers being obliged to suckle their own infants. The same increase in adult, and diminution in infant mortality, was seen during the Lancashire Cotton Famine, when the mothers were not at work in the mills.*

The reason of this is simple. Mother's milk is a perfect and sufficient food for the young infant. In the absence of mother's milk, to provide a perfect diet for an infant needs knowledge, great care, and pains, patience, and a certain amount of extra expense, in addition to the cost of the food for the rest of the family. When instead of a diet of breast milk the infant is fed on milk that is sour, on undiluted cow's milk, on starchy food which it cannot possibly digest, on miscellaneous diet from the parents' table, or when some essential ingredient is absent from the diet, the diseases that will follow can be predicted with a great amount of certainty. Ignorance and carelessness will certainly produce such diseases in town or country, but the result is worse in towns because of other surrounding conditions. The complete ignorance of many young girls who become mothers as to everything connected with the most serious

* *Vital Statistics*, by Dr. H. Newsholme.

responsibilities of their lives is a serious defect in our national education.

The effects of sour milk are so serious that we must dwell in some detail upon this subject. All milk exposed to the air at ordinary temperature becomes in a little while sour and unfit for food. This is only a question of time. The souring is due to the action of the germ called *Bacterium lactis*. This is always present in the dust of the air, and falls into the exposed milk; a kind of fermentation is set up, and the milk sugar becomes changed into lactic acid; thus the milk becomes sour. This is not the only change that occurs; other kinds of decomposition go on and give a rancidity to the milk. Nothing helps more to turn milk than putting it in vessels that are already fouled by sour milk. Every dairymaid knows the incessant cleansing, scalding, and scouring of pans that is necessary to prevent the ruin of her work. Similar care is of vital importance in the nursery. Unfortunately the common feeding bottle is a regular germ trap. The glass tube, the screw cap, the teat and indiarubber tubing are specially liable to harbour germs, and even when the nurse considers that the bottle has been duly cleansed and that it is ready for use, it will often be found more or less foul; whilst among careless and dirty people the bottle often emits a rancid, sickening odour.*

Scrupulous care must be taken to prevent the infant from ever swallowing a drop of sour milk. Sour milk has been the cause of fatal illness to countless children. It sets up irritation, vomiting, and diarrhœa, and catarrh of the stomach and bowels. It causes thrush and other lesions. These conditions may be so severe that when the supply of milk is discontinued the functions of the digestive organs prove to be so disordered that all food is alike rejected and the child dies.

Lister's Discovery.—If fresh milk be boiled to kill any existing germs, and then be so sealed up that nothing can enter, it will remain free from fermentation and decomposition and sourness. It was Lister who established this fact,† and his discovery was a momentous one, for the recognition of the fact that germs entering organic substances can change their composition and alter their properties, and that the exclusion of all

* Of thirty-one feeding bottles examined by H. Fauvel, twenty-eight contained in the glass tube, or teat, a quantity of mycelium, numerous very active bacteria, and a few vibriones. Several bottles washed carefully and considered to be ready for use contained, nevertheless, a large quantity of microbes.

† Pathological Society's *Transactions*, 1878.

germs can prevent such changes, is the principle which is the basis of the antiseptic method of treating wounds.

We shall show hereafter how this principle is applied to the sterilisation of milk (p. 67).

Other germs than the *Bacterium lactis* may be present in milk, and may by their action tend to make it unfit for food. If, in the cowshed and dairy, proper precautions are not taken, the milk will be contaminated, not only by the stale and sour cans, but also by the dust and dirt which are inseparable from the animals and their surroundings. In addition to this the **germs of specific disease** may be carried by milk. Typhoid fever has been spread by contaminated water being added to the milk, and outbreaks of typhoid have followed the beats of individual milk dealers. Diarrhœa, dysentery, and cholera have been disseminated in a similar way, especially in India, where insanitary practices prevail to an almost incredible degree. Scarlet fever also has been conveyed from a dairy or farm where the disease has been present amongst the residents. It seems clear also that the germs which cause tubercular disease—*e.g.*, consumption of the lungs or bowels—may be conveyed by milk from a tuberculous cow.

Fortunately the healthy human stomach is able, to a great extent, to resist the effects of germs which enter it, but there is a limit to this power. When the germs are many, when the milk has been for some time exposed to their action, when the child is young and delicate and its digestive powers feeble, then bad results are most liable to occur. There can be no doubt that the diarrhœa and other diseases of the digestive organs, to which infants are so liable, are largely due to milk and other food rendered unwholesome by the action of germs. Fortunately these germs can be destroyed by heat.

SPECIAL DISEASES OF INFANCY.

We shall now say a little about some of the particular diseases which the causes we have been considering may produce, because the prevention of these particular diseases has to be kept in mind in the care and feeding of infancy.

Gastro-enteric catarrh, or inflammation of the mucous membrane lining the stomach and bowels, has already been alluded to.

It may be caused by sour milk, or any kind of decomposing food, especially decomposing animal food. It may also be set up by the presence in the stomach and bowels of lumps of undigested milk-curd, or by the premature use of starchy food, which is very

apt to ferment in the bowels; also, generally, by the use of any kind of food which the infant cannot digest; by the use of unhealthy water to dilute the milk; or by the presence of sewer gas in the air of the house. Chilling through insufficient clothing of thighs and abdomen helps to intensify the disease.

Climate and season affect the prevalence of the disease. It is, for example, much more fatal in the United States than in England, the hot seasons especially bringing a serious infant mortality from this cause.

Its most prominent symptoms are vomiting, which may become so serious that nothing can be retained; diarrhœa, with offensive, slimy, or blood-stained motions; griping pains and flatulence; and the constitutional symptoms, and, especially, the rapid loss of flesh consequent on the foregoing. The different diarrhœal diseases are variously classified by authors and, of course, they vary in intensity from transient looseness of the bowels to dysenteric or choleraic diarrhœa. We must add that chronic gastro-enteric catarrh is a factor in the production of other diseases—*e.g.*, rickets, because of the chronic state of malnutrition which it maintains.

Rickets.—One of the chief problems in infant-rearing is to prevent the development of rickets. This disease affects profoundly the whole system of the child, although its effects are most conspicuous in the bones. It is very important to recognise the earliest signs of the development of this disease, for it is eminently preventible and curable. The bones in rickets are too soft; they are deficient in hard earthy matter. Either they fail to become hard, or they soften again after they have begun to harden. Consequently, they give way under pressure. The legs may thus become bowed, or knock-kneed, and the bones may be twisted as well as bent. The arms, too, may be bent, especially if the child crawls much on all-fours. The sides of the chest become flattened and depressed, or even concave. The fontanelle remains long unclosed, the forehead is broad with prominent forehead bones, and the top of the head is wide and flat. One sign of rickets—important because easily recognised—is the swellings at the end of the long bones, just above the joints. This is due to the enlargement of the epiphyses, and it produces the appearance shown in Fig. 9. Still more easily perceived is the rickety "rosary." If in a rickety child we run our fingers along each rib from the breast-bone outwards, a little swelling or "bead" is felt at the place where each rib joins the cartilage (Fig. 10). This is a very good way of detecting the onset of the disease. The ligaments in a rickety

child tend to yield. The spine is weak, and tends to form a rounded curve of the back when the child sits up, which can, of course, be readily straightened by the recumbent position.

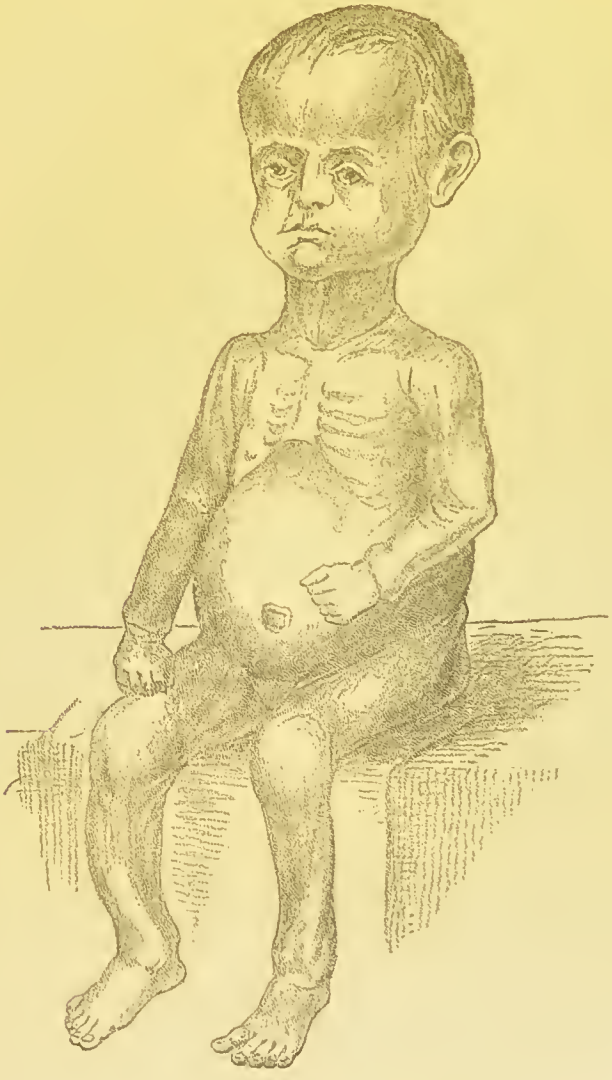

Fig. 9.—"Rickets" (from life).

The abdomen is unduly prominent. This so-called "pot-belly" is due principally to flatulent distension, but the spleen and liver are sometimes enlarged. The children tend to become pale and anæmic. Teething begins late and progresses slowly, and the

teeth tend to early decay. The muscles are weak, the children walk late. Sir William Jenner long ago pointed out three characteristic symptoms in rickety children. They sweat much from the head at night, causing a wet place on the pillow where the head has rested ; they kick the clothes off at night to obtain coolness ; and they dislike jolting in the arms which most babies enjoy. Rickety children are specially liable to bronchitis and other lung diseases, also to spasmodic croup. They are liable to

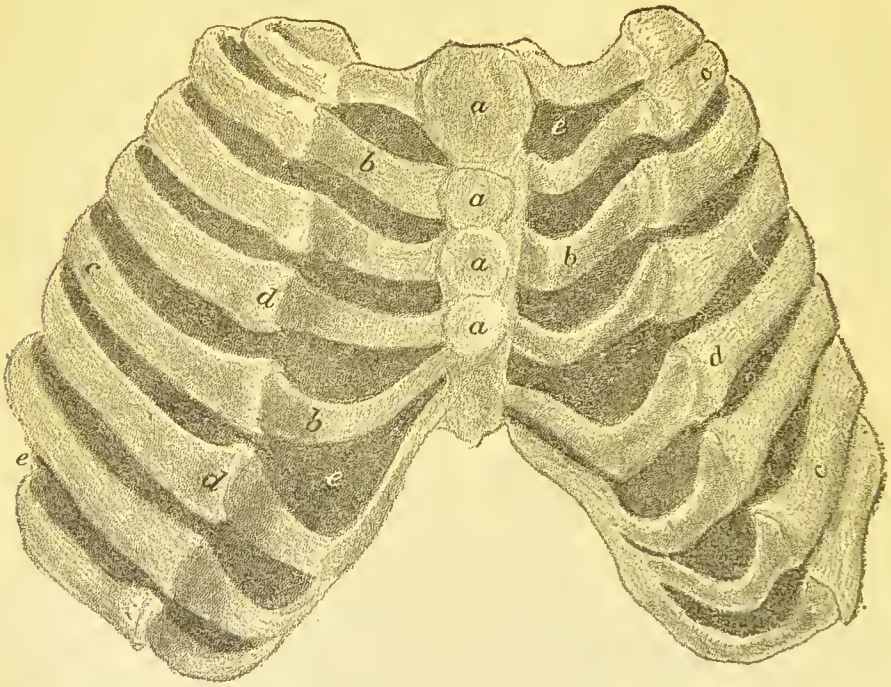

Fig. 10.—The "Rosary" of Rickets (from a specimen in the Pathological Museum of the Yorkshire College).—*a*, Breast bone; *b*, cartilages of ribs (somewhat shrunken post-mortem); *c*, ribs proper; *d*, beads at junction of rib and cartilage; *e*, intercostal muscles.

suffer gastro-enteric catarrh, diarrhœa, &c. They are apt to suffer from convulsions, especially during teething. Moreover, the ordinary ailments of infancy are apt to affect them with extra severity, and a large proportion of the deaths in infancy occur in rickety children, although the registered causes may be bronchitis, dentition, diarrhœa, convulsions, &c.

What are the Causes of Rickets?—In describing the conditions of life amongst the labouring classes in great towns, we have portrayed the conditions amidst which this disease

prevails most constantly, and reaches its worst phases. Given such environment, the streets will be full of bow-legged children, and the death-rate will be swelled by rickety diseases.

But when we try to state exactly which of these factors are the essential causes of the disease, opinions vary. Rickets is certainly very largely a food disease. It is chiefly found in those who have not been suckled at all, or who have been weaned prematurely. It is very commonly found in those who have suffered much from vomiting and diarrhœa, and in those who have been fed too early on starchy foods. It is found when good cow's milk cannot be obtained, or when the child for some reason or another cannot take it. Some have laid the chief stress on deficiency of fresh air, or deficiency of sunlight. Inherited constitutional debility also helps to produce rickets.

Pale, anæmic, over-worked mothers, debilitated by frequent child-bearing, are apt to beget such children. Some authorities have maintained that the disease is hereditary. Syphilis helps to cause it, but can only be regarded as an occasional factor. Probably those are nearest to the truth who look upon most of the above as predisposing causes, but who find the essential cause in the deficiency of some element essential to the diet of children. It has been strongly urged that it is a deficiency of lime in the drinking water that is the fault. Unfortunately this theory is not tenable; one can only wish that the matter were so simple that an adequate quantity of lime would prevent the disease; but rickets occurs in limestone districts, and in infants fed on foods rich in lime. Probably the defects which are most potent are deficiency of fatty material (especially cream) and of nitrogenous material. These elements are very apt to be seriously deficient in infant's diet. Cream is wanting because of the poor, watery milk used. Nitrogenous matter is in too small amount, because when the child vomits its milk something is substituted which contains little or no proteid, especially starch. It is obvious that no amount of predigestion or dextrinising of starchy foods can put nitrogen into them.

To sum up, rickets is due to improper diet, is predisposed to by inherited weakness of constitution, and is fostered and made worse by bad hygienic surroundings and by parental ignorance and neglect. *

* It is, however, very difficult to make any one theory fit all cases of rickets. Occasionally we find the disease where none of the above causes seem to be in action, and sometimes we do not find it where conditions which seem adequate to produce it are present. We know well many of the links in the chain of causation, but not the whole chain. Perhaps there is a micro-organism to be found.

Rickets is most likely to develop between the middle of the first and the end of the second year, but it may be even earlier or later than this.

Scurvy or Scurvy-Rickets.—This is another disease caused by defective diet which has attracted a good deal of attention of late years.* It is well known that the disease called scurvy, which was formerly the cause of so much suffering and loss of life in the navy and merchant service, is due principally to the deficiency of certain elements from the diet, and that these elements are supplied in our ordinary diet by the fresh animal and fresh vegetable food which we take. For instance, meat juice, milk, potatoes, and cruciferous plants and certain fruits, especially lemons and limes, are antiscorbutic or scurvy-preventing. Various unsanitary conditions combined with the defective diet help to produce the disease. Scurvy is not often seen now. The diet of most people under ordinary circumstances includes sufficient of the requisite kind of food, and where long voyages are made care is taken to provide an antiscorbutic diet. It is for this reason that lime juice is taken in Arctic and other long expeditions.†

A very important service has been rendered to medicine, by the recognition of the fact that in children who are fed artificially by those ignorant of the principals of the art, the diet may be so defective in scurvy-preventing elements that a form of scurvy may develop in the infant.

The principal symptoms of the fully developed disease are as follows:—The gums are swollen and spongy, and are apt to bleed, especially at the place where a tooth is being cut. There will probably be also a very offensive odour from the mouth. There is tenderness and swelling of the limbs in general and of the legs in particular, the soft parts as well as the bones being swollen. The bones are swollen along the length of the shaft, and not at the ends only as in rickets. The child is pallid, sallow, wasted, and possibly feverish, is very fretful, and fears to move the tender limbs. There may be spots like bruises on the skin. The urine may contain blood. The disease is curable if dealt with in time, and, better still, is preventible.

* See a good article by Dr. T. Barlow, *Med. Chir. Soc. Transactions*, vol. lxvi., and especially his Bradshaw lecture, *Lancet*, Nov. 10, 1894, also Dr. Cheadle's articles, *Lancet*, Nov. 1878 and July 1882; and his work on *Artificial Feeding and Food Disorders of Infants*.

† Lime juice is prepared from the fruit of the lime, *Citrus limetta*, and must not, of course, be confounded with "Lime water," a solution of the mineral "slaked lime."

Now, although the fully developed disease may not be very commonly seen, many children who do not develop the above train of symptoms may fail to thrive, and may fall into ill condition because the antiscorbutic element in this diet is deficient. Hence the above considerations teach us an invaluable lesson as to the constitution of a healthy dietary.

Thrush.—Sometimes within the first few days of life, if the tongue, the interior of the lips and cheeks, and the palate of the infant be examined, there may be found scattered over the mucous membrane patches whose appearance is compared to "hoar frost." The cause of this is the growth of a fungus upon the mucous membrane, and the effect of the condition is to cause irritation and heat in the mouth, pain on swallowing, and often some irritation of stomach and bowels, diarrhœa, and general feverishness. The conditions which give rise to the onset of the disease are the feebleness of infancy, the presence in the mouth of sour milk, the use of an imperfectly cleansed teat, and, generally, the neglect of cleanliness in feeding. The disease is not serious in an otherwise healthy child, but may be the starting point of a serious condition of stomach and bowels, when the child is also wrongly fed and ill cared for. Other forms of inflammation of the mucous membrane of the mouth may be associated with thrush. The precautions to be taken will be described hereafter (p. 97).

Rheumatism.—To this also we must direct attention. There is a popular fallacy that a child can be "too young for rheumatism." Children are very liable to this condition, only the joint affection is often insignificant, while heart affections are severe. It is a common and painful experience to discover in children brought to hospital for general weakness and failure of health the presence of valvular heart disease. Amongst causes which are preventible, we may mention cold and damp. Cold acts often on account of *insufficient clothing* (see Chap. iv.), and undue exposure and from draughts. Damp—from damp feet damp clothes, sitting on damp ground, damp dwelling-houses, (especially cellar dwelling-rooms), and damp beds. We emphasise the need of *precautions against rheumatism*, as part of the hygiene of infancy and childhood. The so-called "growing pains" are commonly rheumatic.*

We will now give in a tabular form the principal causes which hinder the thriving of infants, adding to those already discussed others to which we can only give brief mention :—

* The student is referred to Dr. Cheadle's work on *The Rheumatic State in Childhood.*

Table Showing Principal Causes why Infants do not Thrive.

1. Congenital Causes.

Premature birth with consequent puny size and feeble development. Plural pregnancy.

Malformations and defects. Diseases of unborn child.

Injury at birth, and diseases incident to birth.

Actual diseases transmitted from parents, such as tubercle, syphilis, acute infectious disease.

Feebleness of constitution transmitted from parents from causes, such as the following:—Parental insanity, intemperance, acute or chronic disease, destitution. Especially disease, injury, loss of blood, mental shock, or great anxiety or semi-starvation during pregnancy of mother.

2. Faulty Surroundings.

(*a*) *The house is badly built.*

Damp, cold.
Ill-ventilated, ill-drained.
Dark, deficient in cubic space, overcrowded.
Is on unhealthy soil.
The nursery in particular is not healthy.

(*b*) *The neighbourhood is deficient in fresh air and open spaces, or in other particulars.*

Is over-populated.
Sunlight is deficient.
The atmosphere is fouled by various causes.
The soil is not drained.
The water supply is unwholesome or scanty.
Endemic disease prevails.
The birth takes place in a foreign, unhealthy climate.

3. Faulty Lactation.

The mother does not suckle infant, cannot suckle enough, suckles too long. Is in bad health. The milk is poor.

The wet-nurse is unsuitable.

4. Faulty Artificial Feeding.

(*a*) *The milk is unwholesome.*

Is sour.
Is given from a sour bottle.
Contains various germs.
Is adulterated.

(*b*) *The milk is wholesome*, except that it is poor, or that it is not properly prepared by dilution or otherwise.

The diet of the child is deficient in one of the following elements:—

Proteids.
Fat.
Carbohydrates.
Salts.
Antiscorbutic element.

The child is fed on food which it cannot digest, and especially is prematurely fed on starchy food.
The child is overfed or underfed.
The food is badly prepared or not fresh.

5. Faulty Personal Hygiene.

The child is generally neglected, is entrusted to inexperienced or careless nurses, perhaps to juveniles.
Is not taken out enough. Is over exposed.
Is not properly clothed, and not kept warm.
Is kept in hot ill-ventilated rooms.
Is not kept clean, is dirty, chafed, excoriated.
Has pediculi, scabies, &c.
Has had severe fall or accident.
Is treated with deliberate cruelty, perhaps associated with illegitimacy, baby-farming, life assurance, &c. Is drugged.

6. From some one or more of the above Causes, or from Infection, the Child has acquired Disease.

(*a*) Disease of stomach and bowels, from bad feeding, &c.
(*b*) Rickets, scurvy, tuberculosis and scrofula, rheumatism, anæmia.
(*c*) Acute disease, specific or otherwise, which leaves chronic debility—*e.g.*, measles, scarlet fever, whooping-cough, bronchitis, &c.

It may be useful also to recapitulate the principal causes which render cow's milk unhealthy for infants.

1. The ill-health or ill-condition of the cow supplying it.
2. The food of the cow is unsuitable, it may, for instance, be fed on turnips, brewer's grains, or distillery refuse.
3. The cowshed is unhealthy for the cow.
4. There is want of cleanliness in the process of milking, and dirt enters the milk in the cowshed.
5. There is want of cleanliness in the vessels used for receiving, carrying, or storing the milk.
6. The milk is kept in an unhealthy atmosphere (*e.g.*, one contaminated by sewer gas).
7. Water used for diluting the milk or for washing vessels is unhealthy.
8. The milk is adulterated.
9. The milk is sour from lapse of time, or by keeping in hot place, or from sour vessels.
10. There is infectious disease amongst dairy staff.

In considering what has been said in this chapter one cannot fail to be struck with the number and variety of the causes

which affect the health or increase the mortality of infancy. Life is most liable to perish in its earliest stages, and whatever affects the conditions of life of the people in general affects those of infant life in particular.

Thus it comes to pass that when municipal authorities, and the constituencies who elect them, suffer their rivers to be fouled and their skies to be darkened; when their sewage system is faulty and their water supply defective; when "Jerry builders" have free play and slums are undemolished, those who suffer most will never complain, for they will simply droop and die.

All the problems of sanitary and social science seem to be focussed in this question. We have space left for but one remark on the wider aspects of our subject. Has not the time come when some systematic instruction in the care and nurture of children should be given to the girls and young women who will shortly become the mothers or nurses of the rising generation, and who too often will undertake such responsibilities in gross ignorance of almost all that is therein involved, and with the most disastrous results to the objects of their care? Of all branches of the education of women, is there one more important than this? Is there one more neglected than this?

CHAPTER III.

On Infant Feeding.

I. NATURAL FEEDING.

Shall we encourage every mother to suckle her own infant? Without doubt. It is the best thing for the health of the mother. It materially increases the child's prospects of surviving its infancy. Even if the mother does not hope to suckle for the full time, she can, at least, begin and go on as long as possible, and this will be very much better than never giving suck at all.

Until the third day after labour milk will not, as a rule, be present in the breasts in any considerable quantity. But even if the infant should go without food for the first three days, no serious result will be caused. It has been abundantly nourished up to the moment of birth, and it comes into the world with sufficient reserve of nutrition to enable it to wait for the appearance of its natural food at the usual time. There will, however, be some loss of weight in this period, as has been already explained (p. 28).

There is a rooted belief in the minds of ignorant women that a child must be born hungry, and if it puts its thumb into its mouth, this is considered to prove the fact. Hence the child is made to swallow something as soon as it is washed. Butter and sugar is the favourite *bonne bouche*, only some prefer castor oil. The utmost that can be allowed during this period is a few teaspoonfuls of milk and water (milk, $\frac{1}{3}$, water, $\frac{2}{3}$).

Quantity of Breast Milk taken.—It is important to know how much a healthy thriving infant takes in twenty-four hours, because this is a guide in artificial feeding. The following Table is taken from Bouchaud, who made careful observations at the Maternity Hospital of Paris. The amounts are converted from grammes into avoirdupois ounces.

Amount of Milk taken by Infant at Breast.	At each Sucking.	In Twenty-four Hours.
	ozs.	ozs.
First day, at most, . . .	0·10	1·05
Second day, ...	0·53	5·28
Third day, ...	1·41	14·08
Fourth and fifth day, . .	1·94	19·36
First month, ...	2·11	21·12
Second and third month, .	2·5	21·12 to 24·6
Fourth and fifth month, . .	3·5	24·6 to 28·2
Sixth month, ...	4·2	28·2
Seventh month and onwards, .	0·3	31·7

From Tarnier, Chantreuil, and Budin, *Op. cit.*, p. 181.

Frequency of Suckling.—The child should be put to the breast from the first—*i.e.*, as soon as the mother has had a little sleep, and within twelve hours of labour. Before the flow of milk is properly established, three or four times in the twenty-four hours will be sufficient.

If it be urged that it cannot be right to put the child to the breast before the milk comes, the answer is that this promotes the secretion of milk, and is also beneficial to the mother in other ways. When the breasts have begun to secrete properly, it is very important that the child should be suckled at regular intervals. Suckle the child at first every two hours during the day, and not quite so often during the night (say eight or ten times in twenty-four hours); but from the earliest time practicable, the child must be accustomed to sleep as long as possible in the night so that the mother may get her necessary rest, say from 11 p.m. to 6 a.m.

In seven or eight weeks the child may be suckled every three hours, from 6 a.m. to 11 p.m., and later on six times in the twenty-four hours may suffice.

These general rules may require some variation in particular cases, but it is surprising to how great an extent regularity of habit may be secured in infants by a little patience. Such regularity is exceedingly good for the mother and still more for the child. When children are fed at fixed intervals their bowels will act at regular times, and the mother, knowing when they are likely to act, will be able to "hold out" the child at such times, and thus an early control over bowels and bladder will be acquired, so that it will be possible to keep the infant dry and clean at a much earlier age than when no such discipline is

enforced. Moreover, such a habit is the best possible prevention of constipation and irregular action of the bowels.

Avoid too frequent Feeding.—It is not desirable that the child's stomach should never be empty, and the digestive function never at rest. It is a mistake to feed a child whenever it cries. He may, indeed, cry from hunger, but he may also cry because of indigestion, flatulence, and stomach-ache, and this condition may be due to over-feeding, and remediable by reducing the amount taken, and lengthening the intervals. To suckle a child suffering from abdominal pain may give transient relief, but the cry soon recommences, and the condition is no better.

Mode of Suckling.—The infant must be held horizontally lying on the side corresponding to the breast from which it is fed, and supported by the corresponding arm and hand of the mother. With the first and second fingers of the other hand she supports the nipple, and guides it into the child's mouth, inclining her body forward for the purpose. At the same time the fingers can control the flow of milk, and prevent it from coming too fast. The breasts are to be suckled alternately, one for each meal. The child may go on until he is satisfied. He will then of his own accord drop the nipple, and will probably fall asleep.

Difficulties in Suckling.—The nipples may be flat or retracted, so that the infant cannot take hold. To remedy this the breast may be drawn with a breast pump, of which a good form is given in Fig. 11; or another infant, older and more experienced, may be employed to draw out the nipples; or a nipple-shield may be used. To make the infant take this, it may need to be "primed" by filling it with milk, by suction or otherwise, before it is put to the child's mouth.

Fig. 11.

Drawing out the nipples is popularly called "breaking the strings of the breast," whatever that may be supposed to signify. Occasionally the nipple is so drawn in that the breast is useless for suckling. This chiefly occurs as a consequence of previous inflammation in the breast.

For the method of preventing and treating chapped and fissured nipples, and inflammation and abscess in the breast, we must refer the reader to any standard work on Midwifery.

Again, the child may be unable to suck because it is weak and premature. It must then be fed with a spoon. If it cannot swallow properly our resource is in forced feeding (see p. 102). Obstacles are also caused by the presence of hair-lip or cleft palate (see p. 104).

On the subject of *Tongue-tie* see p. 12.

If an apparently healthy new-born child shows almost no inclination to suck, although the breasts are full and the nipples healthy, it sometimes happens that the intestines are loaded and that a gentle purgative will set matters right (*Tarnier*). Occasionally we meet with an infant who, without obvious reason, will not take the breast, and has to be fed artificially. These cases are very rare, and success will usually be obtained by perseverance.

The Wet-Nurse.—If a child's own mother cannot suckle it, recourse may be had to the breasts of another woman. In this country wet-nursing is not in vogue to anything like the extent observed on the Continent. In Paris, for instance, we read of country women flocking into the bureaux, and even borrowing or hiring infants more healthy looking than their own to assist them to obtain the recommendation of the doctors. In Austria we hear even of a strike of wet-nurses with a demand for an eight-hours' day.* Thus the Continental doctor can develop the art of selecting or rejecting wet-nurses, whilst in this country we have often to take what we can get.

In the Selection of a Wet-Nurse † the following principles should guide us :—

She should be a vigorous, healthy, married woman, active and intelligent. In particular she must be free from scrofula, tubercle, syphilis, and from alcoholism. She ought to have a good digestion, and be free from skin disease, from carious teeth and offensive breath. She should have no uterine affection, nor suffer from much whites.

How to Judge of the Quality of Breast Milk? ‡—It should be rich, and not too thin and watery. It must be remembered, however, that human milk is naturally thinner and more watery than cow's milk.

* *Lancet*, May 19, 1894.

† *Nourrice* is the French equivalent; *Saugamme*, the German; and *Nutrice* or *Batia*, the Italian. In India the term is *Amâh*.

‡ See Appendix.

The specific gravity may be taken with an ordinary urinometer, and it should be 1,030. That of cow's milk is about 1,029.

The reaction is persistently alkaline, and the taste is not usually grateful to the adult palate.

Under the microscope the fat globules are seen as in Fig. 13, M. Fig. 13, C, shows colostrum corpuscles. Within a few days after labour these are reduced to an inconsiderable proportion, and in four or five weeks they quite disappear. See also Fig. 12.

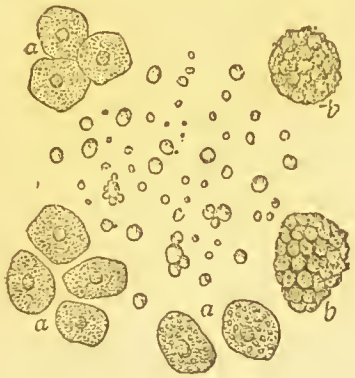

Fig. 12.

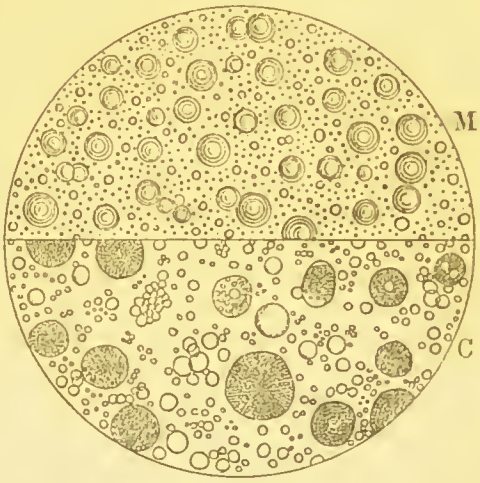

Fig. 13.

Fig. 12.—Milk from breast when first secreted (after *Gerlach and Tarnier*) —*a*, Glandular cells from the mamma; *b*, colostrum corpuscles; *c*, milk corpuscles.

Fig. 13.—M, Microscopic appearance of milk (from Landois and Stirling's *Human Physiology*). C, Microscopic appearance of colostrum.

The condition of the nurse's own infant presents the best evidence as to the nutritive value of the milk. It should be plump and healthy, and free from signs of rickets or constitutional disease. Other things being equal, preference should be given to a country woman rather than to a resident in a town. She may have been confined two months or more. Most newborn children can take milk from breasts that have been yielding for from two to six months, but the nurse's confinement should not have been too far separated from that of the nursling's mother. She should have good nipples and good-sized mammary glands, but it must be remembered that the large size of a breast may be due to accumulation of fat as well as to

gland tissue. Sometimes it happens that one wet-nurse will succeed where another fails, so that if the nursling do not thrive, a change may be tried. The occurrence of pregnancy during lactation should be a reason for discontinuing the nurse.

If *menstruation* be re-established during suckling, it will often happen that the milk will not agree with the infant, or that the nurse cannot stand the double drain on the system. At the same time, if the milk does *not* disagree with the child, and the nurse keeps well, it may not be necessary to dismiss the nurse. There is another consideration that we cannot overlook. If the employment of any particular nurse would be likely to involve sacrifice of her own infant's health for the benefit of the child of another mother, surely no medical man could advise the engagement.

Regimen for a Nursing Woman.—A quiet life is needed, with freedom from excitement, worry, and fatigue, with plenty of sleep, regular hours for rising and retiring, regular meals, and gentle exercise in the fresh air daily. The bowels should be kept regular by laxatives. In a florid woman, with full habit of body and a tendency to constipation, the use of saline purgatives will tend to increase the flow of the milk. Over-feeding must be avoided. This is a mistake sometimes made when wet-nurses are taken to reside in a family.

As a rule, there is needed a generous diet of plain, well-cooked food in good variety. Nitrogenous food increases the richness of the milk more than a diet very rich in fatty element. A fair amount of fluid should be drunk, especially when the milk tends to scantiness. Thus, cow's milk, cocoa, soups, gruel, &c., may be employed, and iron may be prescribed for anæmia. Rich pastry, high-seasoned dishes, and much green vegetable must be avoided.

Should **alcohol** be used by nursing mothers to increase the flow of milk? There is a wide-spread belief that porter and beer are almost necessary during suckling, and they are in exceedingly common use in England to-day for this purpose. On the other hand, this, like other traditional and popular customs, is being called in question by various authorities to-day. Dr. Lauder Brunton,* in his standard work on Pharmacology, says that "Beer and porter stimulate the secretion of milk for a short time, but they produce no proportionate benefit in the child, and nursing mothers are, as a rule, much better without alcohol, and should rather take milk instead."

Dr. Robert Barnes says that while some women nurse well on

* *Mat. Med. Pharmacology, and Therapeutics.*

stout, others are injuriously affected. Some English women and most women of other nations nurse well without it. Excess is dangerous, because alcohol passes into the milk and is likely to injure the child. *Ebrii gignunt Ebrios.* He advises us to use the smallest possible quantity that can be given with advantage.* The late Dr. Leishman dwells on the great improvement that often follows the diminution or discarding of stimulants (*System of midwifery*). To this we may add that any one who will make a good trial of a non-alcoholic regimen will obtain excellent results.

Certain Drugs taken by the Mother are Excreted in the Milk.—As examples, we may instance the active principles of rhubarb, senna, scammony, jalap, and of castor oil; sulphate of magnesia, iodide of potassium, and salts of arsenic, antimony, bismuth, iron, lead, mercury, zinc, copaiba, turpentine, and aromatic oils (such as anise, dill, and cumin).† Opium is another drug of great importance, as it may act strongly on the child. Acids are apt to pass into the milk and cause griping in the child. Quinine passes into the milk in only insignificant quantites, and there is no reason why it should not be given to mothers if they require it, as in malarial districts.‡ Sometimes the above facts are made use of in order to administer drugs to an infant indirectly through the mother's milk.

How long should Suckling be continued? — Children should be fed by the breast alone for six months, and if at the end of that time the child is thriving well, and the mother is maintaining her health, no change need be made in the diet. Supplemental feeding may, however, be needed whilst suckling is continued. There is no absolute rule for the time of weaning. Nine or ten months is about the usual time in England, some can go on for eleven or twelve months, but the child should not be suckled after that. As to the rule suggested by some that the earlier or later appearance of the teeth may be taken as a guide towards lengthening or shortening lactation, we must bear in mind that lateness of teething may be a sign of rickets, and that a poor quality of the milk may be a cause of this, especially when associated with too prolonged suckling.

Reasons for Anticipating the usual Time of Weaning. —The milk is insufficient; the mother is beginning to lose weight and to suffer from depression, langour, backache, head-

* *Obstetric Medicine and Surgery*, vol. ii.

† Lauder Brunton, *loc. cit.*

‡ See paper by Oui of Bordeaux, *Ann. de gynécol. et d'obstétrique*, November, 1892.

ache, dizziness, palpitation, anæmia, &c., without obvious causes; menstruation is re-established,* conception has taken place; the breasts are severely inflamed and suppurating, or the mother acquires acute disease. If the mother has a tendency to epilepsy, insanity, phthisis, or suffers from alcoholism, it may be from the first undesirable to permit suckling.

Again, if the infant is not thriving, or if there are signs of the development of rickets, on account of the poor nutritive value of the mother's milk, weaning may be indicated. At the same time it is important not to wean on too slight provocation, as some of the above symptoms in the mother may be due to temporary causes, and may be relieved in a day or two.

Weaning.—It may be necessary to wean suddenly, on account of the condition of the mother's health, or because, as occasionally happens, the infant steadily refuses all artificial food while it can obtain breast milk. The strength of purpose shown by an infant under such circumstances is sometimes extraordinary.

Weaning is, however, best accomplished gradually, for in this way the stomach is best trained to its new diet, and if the stomach be upset the natural feeding can be resumed for a time. Moreover, the gradual process is easier for the mother.

It has been recommended that weaning should occupy one month, and be conducted in the following way:—

First week	feed	naturally	6	times,	and	artificially	once per day.
Second	,,	,,	5	,,	,,	twice	,,
Third	,,	,,	3	,,	,,	4 times	,,
Fourth	,,	,,	1	,,	,,	6 times	,,

The consideration of the diet for supplemental feeding, and for feeding after weaning, forms part of the whole question of artificial feeding which we proceed to consider.

Suckling in Case of Twins.—Twins occur in England about once in eighty births. The children are usually below the average in size and strength, and their mortality is high. It often happens that one of the two is decidedly better developed and more vigorous than the other. The mother will rarely have milk sufficient to feed both. What course shall we advise to be pursued? Shall she divide her milk equally between the two, and supplement this in both cases with artificial feeding, or shall she from the first choose one to suckle and one to feed by hand?

* The occurrence of a slight "show," or of one or two very scanty menstrual periods is fairly common during lactation, but it is to the establishment of something approaching regular menstruation, or to the presence of irregular, but considerable, sanguineous discharge that reference is here made.

And in this case shall she elect to suckle the stronger that she may take the means most likely to secure the survival of at least one of the twins, or shall she prefer to suckle the weaker one because that has the least chance of being successfully reared artificially?

Under ordinary circumstances, and assuming care and intelligence, in carrying out artificial feeding, we recommend that both shall share the great advantage of a diet consisting, at any rate partly, of mother's milk. If any difference is made it should be in favour of the one who is thriving the least satisfactorily. On the other hand, with poor and ignorant and careless parents, and in the presence of marked immaturity of one of the twins, one might consider that this plan would probably lead to the survival of neither, and, therefore, decide to give the best chance to the one that seemed most likely to survive. We leave this delicate problem to be settled as occasion arises.

II. ARTIFICIAL FEEDING.

Human milk is the type of a perfect food. It contains all the requisite elements in due proportion. The problem of artificial feeding lies in a nutshell. It is to provide a food which shall correspond as closely as possible to this, the natural diet of infancy.

In the absence of human milk, cow's milk is the staple diet of infancy in the immense majority of cases. Let us consider first the use of cow's milk, and inquire how cow's milk differs from human milk, and how it can be made to resemble it.

The following table shows the comparative composition of the two :—

Reaction.	Sound Dairy Milk. Feebly Acid.		Human Milk. Persistently Alkaline.	
Specific gravity, .	1·0297		1·0313	
	Extremes.	Average.	Extremes.	Average.
Fat (cream), . .	3 to 6	3·75	2 to 7	4·13
Milk sugar, . .	3·5 ,, 5·5	4·42	5·4 ,, 7·9	7·0
Proteids, . .	3 ,, 6	3·76	0·85 ,, 4·86	2·0
Mineral matter, .	0·6 ,, 0·9	0·68	0·13 ,, 0·37	0·2

The results of various observations vary. This table is taken

from an article by Dr. A. R. Leeds in Starr's American *Text-book of the Diseases of Children*, 1894, "On the Chemistry of Milk and of Artificial Foods for Children." The author acknowledges the use he has made of this able article in preparing this section.

These differences in composition may be shown in a graphic manner by means of the following diagram :—

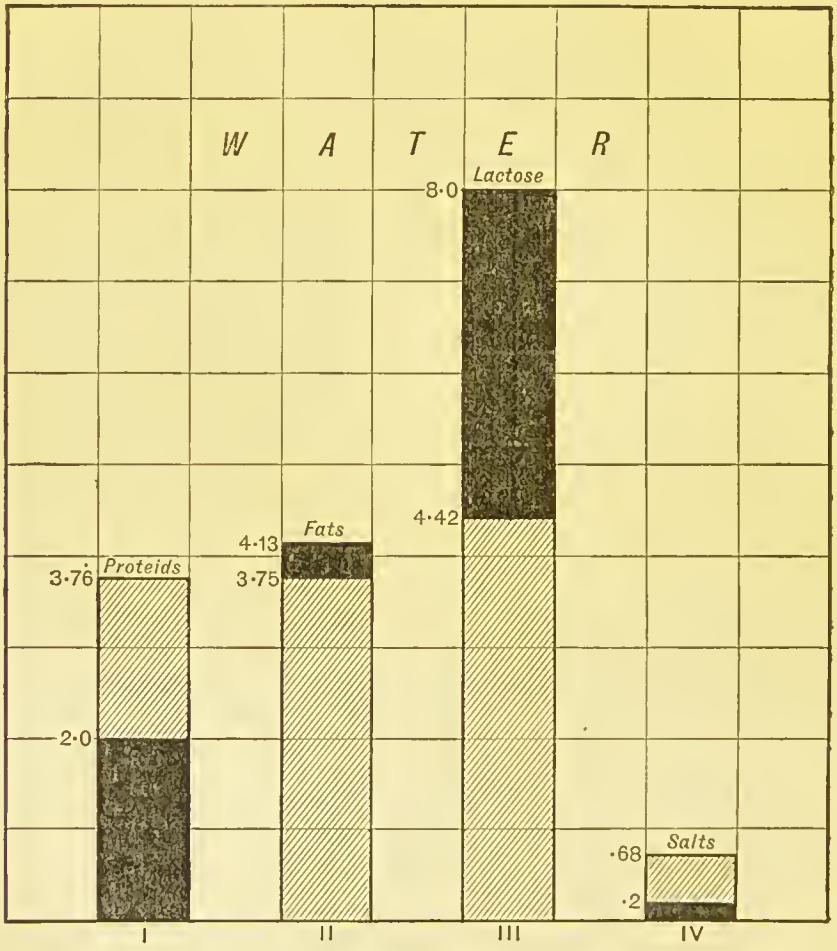

Fig. 14.—Diagram to show relative composition of cow's milk and human milk.

Columns I. and IV. show by their full height the amounts of proteid (albuminous) and earthy matter respectively contained in cow's milk, and by the dark parts the corresponding amounts in human milk. Columns II. and III. show by their full height the average amount of fats and lactose contained in human milk,

and by their light parts the corresponding amount in cow's milk. The remainder of the square shows the amount of water in each case.

The above analysis shows the variation of the amount of the different constituents in milk, and explains the different results obtained by various observers.

The most important point to note is that in cow's milk the albuminous matters (or proteids) are on the average one and three-quarter times as much again as in human milk. Now, the albuminous material is of two kinds, the part which forms curd and which is called *casein*, and the part which will not form curd and which is called *lact-albumen*. In cow's milk about four-fifths of the albuminous matter will clot or form curd during digestion, but in human milk only about one-half. Taking equal weights of the two kinds of milk, cow's milk yields about four times as much clot as human milk (*Leeds*). This is the principal cause of the difficulty experienced in feeding infants on cow's milk; in other words, cow's milk contains too much cheese.

Therefore no young infant can be fed on pure cow's milk. This would most certainly set up acute indigestion, going perhaps on to inflammation of the stomach and bowels.

The analysis of human milk here given shows the **essential constituents of a perfect diet for infants**, and the proportion in which they should be present.

That is to say, the diet must contain—

Nitrogenous or albuminous material (casein and lact-albumen).
Carbohydrate or saccharine or starchy material (lactose or milk sugar).
Hydrocarbons or fats (cream).
Salts or mineral matter.
Water.

In fresh milk there is present another element, which does not appear in this analysis, and that is the **anti-scorbutic** or scurvy-preventing agent. If in an infant's diet any one of the above be wanting, or present in deficient amount, the child will not thrive. Hence in prescribing diet for infants we must always see that these elements are present in due proportion, and in dealing with those who are not thriving properly, we must always determine whether any one of these is deficient or wanting.

For example, **nitrogenous** material is perhaps the most important element in diet. Healthy, vigorous development is impossible without it. But if a child should vomit all the curd of the milk, and if we were to substitute for milk a non-nitrogenous diet (as, for instance, some form of farinaceous food), the child would not thrive.

The **fatty** element is only second in importance to the nitrogenous. Fat forms a much larger proportion of the diet required in infancy than of the diet of adult life. It is estimated that an adult needs in twenty-four hours 56 grammes of fat, and that an infant in the same period needs from 30 to 45 grammes—*i.e.*, from a half to three-quarters as much as the adult. Starve the child of fat and it will not thrive.

When the milk is poor in cream, or when milk is abandoned, and the child is fed on farinaceous food, this is demonstrated practically. Fat-starvation is one potent cause of rickets.

The Carbohydrates.—Sugar and starch-containing food are most essential to infant nutrition, but the mistake of omitting these from the diet is not likely to be made. The popular error is on the other side, namely, to give too much, and to give it too early.

Mineral matters are most essential, but milk, farinaceous food, and meat juice all contain these. Iron and lime salts have sometimes to be given medicinally. Table salt must not be forgotten in artificial feeding. Of the anti-scorbutic element we speak elsewhere, but it is important to remember that farinaceous foods are not anti-scorbutic.*

METHODS OF "HUMANISING" COW'S MILK.—1. **Dilution with water.**—Both water and milk to be previously boiled. For a young infant use two parts milk and one part water, and gradually increase the proportion as the child grows. At three or four months it may take half milk and half water; when it is nearly six months, two parts milk and one part water.

It might be inferred that milk with two parts water would be too poor in solid constituents, or that an undue quantity of the mixture would need to be taken to give the requisite amount of nourishment. As a matter of practical experience it is found that this degree of dilution is as strong as a young infant can stand, and that the child will thrive for a while on from 12 to 20 ounces per day. In fact, milk and water is the commonest of all artificial foods in use.

The rules given above are not absolute. **There is no one formula for infant feeding.** Sometimes in the first weeks of life a dilution of from three to one is needed. Some children at six months can take pure cow's milk, but even then some dilution is safer; in fact, it is always best to dilute milk for infants

* For a careful demonstration of these points the student is referred to Dr. Cheadle's most valuable work on *Artificial Feeding and Food Disorders of Infants*. The author acknowledges his indebtedness to this treatise in the preparation of this section.

and invalids, since this aids its digestion. Boiling the milk is advised; first, because this process gives greater security against sourness and deleterious germs; and secondly, because it makes the milk rather more digestible. The effect of heat on the milk is to cause a pellicle of albumen to form on the surface. This is to be skimmed off. The boiled milk is a little more constipating than the unboiled, but the advantages gained outweigh this.

2. **Dilution with addition of Cream and Sugar.**—Dilution with water lessens the relative amount of fat and sugar in the food. This is especially the case with the fat when the milk is poor in cream to start with, as the milk sold in towns often is. Hence the value of the food may be improved by adding cream to the diluted milk. For the same reason sugar may be added. Milk sugar has been recommended as the best for the purpose on theoretical grounds, but ordinary cane sugar seems to do as well and is cheaper.

The formula for the **milk, cream, and sugar mixture** would be a ½ fluid ounce of milk, 1 fluid ounce of water, 2 fluid drachms of cream, and 20 grains of sugar.*

By this combination infants may be successfully reared for six months or more without any other food whatever. If they do not persistently vomit their food, if they gain in weight and maintain good condition, no change need be made; but sometimes it may be plain that the diet does not suit the infant, and one of the commonest difficulties lies in the indigestibility of the curd of cow's milk.

Biedert's Cream Mixture was designed to meet the difficulty of digesting casein. Milk is added to it as the infant grows, and it is often very successful.

His No. 1 mixture contains—

Cream,	4 ozs.
Water,	12 ozs.
Milk sugar,	½ oz.

This contains—

Casein,	1 per cent.
Fat,	2½ ,,
Sugar,	3·8 ,,

To this he adds first 2 ounces, then 4 ounces of milk, and finally it is made to contain equal parts of added milk.†

* Guessing quantities, and the use of the notoriously uncertain "spoonfuls" for measurement, are to be avoided. The nurse should be provided with a glass pint measure, graduated in fluid ounces; and a 2-ounce measure, graduated in fluid drachms.

† Ashby and Wright, *Diseases of Children.*

We may also refer to the *mixture of Dr. A. V. Meigs.* He makes a solution of milk sugar by dissolving 17¾ drachms of milk sugar in a pint of water. (This must be kept cool.)

For feeding the child, take

2 parts cream.
1 part milk.
2 parts lime water.
3 parts sugar solution.

This corresponds approximately to human milk in composition.

The following formula is by Rotch :—

Cream (20 per cent.), . .	1½ ozs.
Milk, ...	1 oz.
Water, ...	5 ozs.
Lime water, . . .	½ oz.
Milk sugar, . . .	2 teaspoonfuls.

3. **Diluents other than Simple Water.**—The casein of cow's milk clots in large masses. If lime water be added to the milk the curd forms in a light flocculent form which is easier of digestion. Lime water contains only ½ grain of lime to the fluid ounce, and about ½ grain of lime should be added for each ounce of milk. In later infancy, when a much less degree of dilution is required, the saccharated solution of lime, which contains 1 grain in 67½ minims, is more useful.

Instead of this, certain mucilaginous substances, which act in a mechanical way, may be employed. For instance, we may use barley water, or oatmeal water, or gum arabic, or gelatine. Bicarbonate of soda, 3 grains to each ounce of milk, may be used for the same purpose. Unfortunately, these simple methods may prove inadequate, especially if the child's stomach has been once upset.*

* The author gives the above statements on the authority of text-books, and because in practice lime water and barley water succeed very well as diluents of the milk in infant feeding, and their utility has been proved by experience. On the other hand, if the student makes experiments in test tubes, he may fail to demonstrate the difference in the precipitated curd in dilutions of milk and water, milk and lime water, and milk and barley water respectively. He will, however, see most plainly the effect of diluting cow's milk in diminishing the solidity of the curd. See also an article by Rotch in vol. i. of Keating's *Encyclopædia*, p. 308, *et seq.*, in which he gives the results of a series of experiments by Drs. Harrington and Townshend and himself, which go to show that, provided that the milk be well diluted, the choice of diluent used has but little influence on the result, so far as laboratory observation goes. In feeding the sick, as, for instance, in typhoid, adequate dilution of the milk is of corresponding importance.

4. **Processes for removing Casein.**—In partial removal of casein, the object is to reduce its proportion to about the amount normal to human milk. Here is a plan for "humanising" cow's milk, which is quoted from Playfair's *Midwifery*, vol. ii., p. 304. "Heat half a pint of skimmed milk to 96° F., that is, just warm, and well stir into the warmed milk a given measure full of Walden's extract of rennet. When it is set, break up the curd quite small, and let it stand for ten to fifteen minutes, when the curd will sink. Carefully separate the curd, place the whey in a saucepan, and boil it quickly. When quite cold, add two-thirds of a pint of new milk to the strained whey, and two teaspoonfuls of cream, well stirring the whole together. If during the first month the milk is too rich, use rather more than one-third of a pint of whey."

There is more than one satisfactory preparation of rennet in the market, such, for instance, as Warren's "Sweet Essence of Rennet," and others. The quantity directed to be used is about two teaspoonfuls to a pint, a little more or less affecting only the time necessary for complete coagulation. It is very important not to allow the temperature to exceed blood-heat, because the curdling power of the rennet would then be damaged. Hence the use of a thermometer is indicated.

If the cost of the essence of rennet be a consideration, we may put into the skimmed milk a piece of rennet about one inch square. This must be removed as soon as coagulation begins, and the same piece of rennet, says Playfair, may be employed daily for a month or two.

5. There is another way of dealing with the casein in cow's milk, and that is partially digesting it beforehand, otherwise called peptonising it.

How to Peptonize Milk.—For this purpose we may employ the Liquor pancreaticus (Benger) as recommended by Sir W. Roberts. These are Roberts's directions:—Fresh milk is diluted with water in the proportion of 3 parts milk to 1 part of water, and a pint of this mixture is heated to boiling, and then poured into a covered jug. When it has cooled down to between 140° and 150° F., 3 teaspoonfuls of Liquor pancreaticus and 20 grains of bicarbonate of soda are mixed therewith. The jug is then placed under a cosey in a warm situation for an hour. At the end of this time, the further action of the ferment is checked by boiling for two minutes. If the ferment acts too long the milk becomes unpleasantly bitter. In fact, children may dislike the taste of the peptonised milk and refuse it. In this case the difficulty may be surmounted by peptonising

condensed milk. Peptonised condensed milk may be bought ready made.

Dr. Leeds advises the use of the "peptogenic milk powder," made by Fairchild & Foster, of New York, and he recommends the following mixture as furnishing a sterilised and partly predigested humanised milk :—

> Take of milk, one half pint,
> Water, one half pint,
> Cream, four tablespoonfuls,
> Peptogenic milk powder, one large measure.
> (The measure is supplied with the powder.)

Heat this on a gas stove or hot range gradually, with constant stirring, so that it shall boil in about ten minutes. It is then ready for use.

Predigested milk is an excellent temporary food. Sometimes we have to deal with an infant who vomits almost everything that is given to it, and with whom nothing seems to agree, and our resources are taxed to the utmost. In such a case some form of predigested food may be invaluable, and may be continued till the child regains the power of healthy digestion. But such food is not to be recommended for the regular diet of healthy children. It is far better that the stomach should develop its own proper functions, and not have to depend on outside help. Hence when peptonised milk is employed the amount of predigestion may be gradually diminished, and the process finally discontinued as soon as possible. A continuous diet of peptonised condensed milk exclusively may cause scurvy (*Cheadle*).

We may refer here to a class of artificial foods called *milk foods*, which are said to consist of the elements of human milk in their due proportion. They are a concentrated humanised milk, and are a convenient temporary substitute for fresh humanised milk.

Condensed milk is in extensive popular use for infant feeding, and it sometimes agrees when ordinary milk disagrees. Its advantages for readiness of preparation, for use when travelling, or when the supply of cow's milk is defective, are obvious. There are two varieties of condensed milk. The one is made by simple concentration of milk, and preservation by hermetically sealing it, the other by concentration, with the addition of cane sugar. The latter keeps much the better. Condensed milk, of course, requires dilution for use; each tin contains directions for this. For instance, Nestlé's milk is to be diluted in the proportion of 1 to 4, or 1 to 5. For infant feeding it

would require still further reduction to $\frac{1}{2}$ or $\frac{1}{3}$ weaker, making a total dilution of from 1 in 8 to 1 in 15. For very young infants it is better to begin with still greater dilution, and to cautiously increase the strength. It has been said that condensed milk digests better than uncondensed cow's milk. Dr. Leeds denies this, and says that the fallacy has arisen because condensed milk is always given freely diluted.

It is said that children fed on condensed milk grow fat, flabby, and unhealthy. The excess of sugar may upset digestion by causing fermentation. There seems to be a deficiency of fat in condensed milk, and it may be deficient in the antiscorbutic element. Probably there has been some exaggeration in these objections, as it certainly often proves a most useful article of diet. On the other hand, we doubt the expediency of feeding an infant for several consecutive months on any one kind of preserved or artificially prepared food to the exclusion of others. Variation in diet, especially in the direction of fresh natural food, is most advantageous.

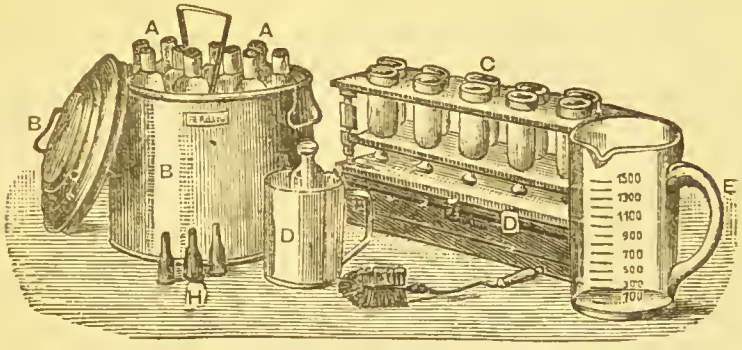

Fig. 15.—Soxhlet's Steriliser.

On the Sterilisation of Milk.—We have already spoken of the dangerous effects of milk-souring germs and disease germs in milk. In fact dairy milk will never be found quite free from micro-organisms, although their presence may not always be a serious matter.

Hence systematic sterilisation by heat has come into use, and in Germany and elsewhere has been carried out to an extent not seen in England. Even small towns and villages in some parts of the Continent have their *depôt* for the sale of duly sterilised milk. Forms of milk-sterilising apparatus for use in private houses are also sold; one of the best of these is that of Dr.

Soxhlet,* of which we give a description, with an abstract of the directions for use issued with the steriliser.

It consists of—(1) A number of thin glass flasks which can stand the temperature of boiling water (AA); (2) a large covered pan in which they can be surrounded with water and boiled (B); (3) a holder for lifting the flasks into and out of the pan (C); (4) a rack to hold the flasks when empty; (5) a small vessel in which a single flask can be warmed for use (D); (6) a graduated jug for diluting the milk according to measure (E); (7) indiarubber discs for closing the flasks (F); (8) metal caps to hold the discs in place; (9) teats to fit flasks (H); and (10) a brush for cleaning.

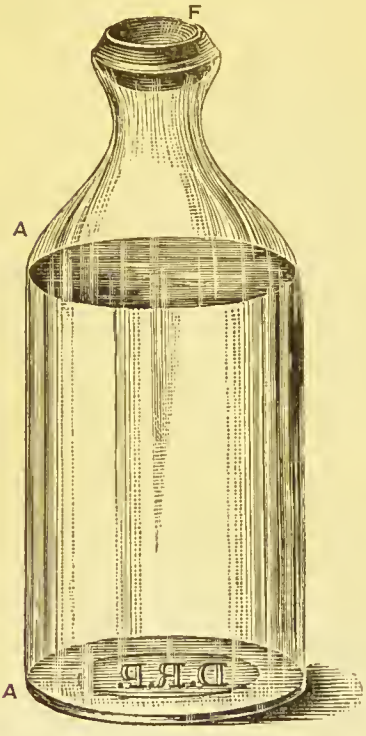

Fig. 15*a*.—Sterilised flask with disc in position showing concavity caused by atmospheric pressure.

Directions for Use.—1. The milk employed must be as fresh as possible, and should be a mixture of the milk of several cows, rather than the so-called milk of one cow. If the physician has ordered the milk to be diluted, this must be done before heating.

2. The flasks should be filled with a quantity sufficient for one day's use. The contents of ten flasks, each holding 150 grammes, will amount to 1½ litres, and this amount of diluted or undiluted milk is more than sufficient for the normal nutrition of an infant for one day. Overfeeding is to be specially avoided.

3. The flasks being arranged upon the holder, an indiarubber disc is placed upon the mouth of each, and the metal cap is put over the disc. The pan is filled with cold water until the water in the pan stands level with the milk in the flasks. The pan lid is put firmly on, and the whole is heated to boiling point on a stove, but not in a closed oven.

* Prof. Dr. Soxhlet's *Neuer Steriliser-apparat für Kinder-milch* is sold by Gerhard Dressler in Leipzig, Tauchaer Strasse, 24, and Metzler & Co. in Munich. Messrs. Maw, Son, & Thompson, Aldersgate St., London, act as the agents here.

4. After the water has boiled briskly for three-quarters of an hour, the steam escaping all the time from the edge of the lid, the lid is removed and the flask holder lifted out. As the flasks cool, the atmospheric pressure, acting on the discs, seals the flasks hermetically.

5. For use one flask is warmed to blood heat in the small vessel, a process which frequent shaking facilitates. When the flask feels neither hot nor cold when laid upon the eyelid, it is ready for use. The disc is then removed by tilting up one edge, the teat is applied to the flask, and the *child fed directly from it.*

6. So long as the discs remain depressed the flasks are fit for use. When one has been opened, any unused remnant must be thrown away; but a closed flask will keep two or three days.

7. After use the flasks must be at once filled with water, so that no drop of milk can dry upon the interior. They must be cleaned with the brush, and some alkaline carbonate may be used for the purpose. The discs also must be thoroughly washed in water. They last longer if every four weeks they are boiled in soda solution.

Pasteurisation.—There is a modified process of milk sterilisation called *pasteurisation*, which is advocated by some. This consists in heating the milk to from 160° to 170° F. for ten or twenty minutes. This heat does not coagulate the lact-albumen. It is sufficient to destroy the germs of tuberculosis, scarlet fever, typhoid, and pneumonia, and to inhibit the development of bacteria, although it does not actually destroy all spores as the higher temperature does. This alters the taste of the milk less than the other process. If it be wished to keep the milk longer than twenty-four hours, especially in hot weather, the higher temperature is more effective (*Rotch*). To pasteurise with Soxhlet's apparatus, only an inch or so of water is put in the vessel, and the boiling is continued twenty minutes, with the lid loosely fitted on.

It cannot be said that a final conclusion has been reached on the subject of milk sterilisation. The question is still under discussion.* Sterilisation may fail to produce healthy milk if the milk has begun to decompose before sterilisation; and the precautions necessary to be taken at the milking-sheds and dairy to prevent contamination of the milk are very stringent. It is difficult also to cleanse the bottles perfectly, and some authorities question the wholesomeness of sterilised milk and dispute its

* See, for example, Cassell's *Year-book of treatment*, 1894, and a series of "Abstracts" in the *Medical Chronicle*, April and May, 1894.

digestibility. Others are quite clear that the sterilised milk digests the best. Boiling also alters the taste a little.

This, however, we say with confidence. When children cannot take ordinary milk diluted, and when they have vomiting, diarrhœa and dyspepsia, it is a most excellent plan to try sterilisation. This will often be followed with very satisfactory results, and it seems clear that the more thoroughly the collection and preparation of milk is supervised, the fewer will be the cases of infants who "cannot take cow's milk." In very hot weather, also, and when diarrhœa is prevalent, the process may be useful.

Precautions as to Milk Supply.—We have already (on p. 49) indicated the principal sources of milk contamination. Some of these are guarded against already by the sanitary authorities;* but when physicians draw up lists of all the precautions that can be taken to secure a pure milk supply, these rival the requirements of the aseptic method in a modern surgical operation, and would involve so much extra trouble and labour that to enforce them on the average cowkeeper and dairyman would be impracticable; although as the basis of private enterprise they are much less utopian. Dr. Leeds in the paper referred to,† gives the provisions of a contract made between a committee of certain medical societies near New York on the one hand, and a competent dairyman on the other, to supply milk which was, when sold, to be stamped as "certified by the said committee and by a chemist, a biologist, and a veterinarian." These most detailed and stringent provisions are well worthy of study. Such an enterprise would have a healthy influence on other suppliers of milk, and it is well worthy of imitation. In many of the poorer districts of a city, the establishment of a *depôt* for the provision of reliable and wholesome milk, sterilised or otherwise, for infant feeding, especially if associated with some organisation for diffusing sound instruction on the whole subject of infant-rearing, would be an object well worthy of absorbing some of the stream of philanthropic energy which flows so freely in our land.

The Feeding Bottle.—What precautions can be taken to avoid the great dangers incident to a sour bottle?

Absolute cleanliness is the great preventive. Fortunately sour milk has a very characteristic odour. The nurse's object must be to secure that this smell is never perceptible. Two

* See for instance, the "Dairies, Cowsheds, and Milkshops Order" of 1885, and subsequent amending orders.

† "On the chemistry of milk, &c.," Starr's *Text-Book of Children's Diseases*.

bottles should be kept, and used alternately. Immediately after use each one must be thoroughly washed out with scalding water, and by repeated rinsing under the tap : a clean bottle brush and some Hudson's dry soap may be used in the process. Be very careful not to let a drop of milk dry up in the bottle. When thoroughly clean, it may be left to soak in the antiseptic solution till wanted. A solution of Condy's Fluid (2 drachms to the pint), or of boracic acid (saturated) will do very well. If the bottle be washed after removal from these solutions, no odour or taste will remain.

The greatest difficulty is presented by corks or stoppers, and by anything which can harbour germs. The feeding bottle with the indiarubber tube is very difficult to keep sweet. The old-fashioned, boat-shaped bottle, with a simple teat over the mouth, is much the best. It has to be held to the child's mouth; but this is an advantage over the other system, for the bottle is removed from the lips when empty, so the child does not go on sucking air from an empty vessel. The bottle may also be made pear-shaped, with a flat bottom, and it may with advantage be graduated in fluid ounces and half ounces. The teats must be conical and made of soft indiarubber, so that they can be easily turned inside out for cleaning.

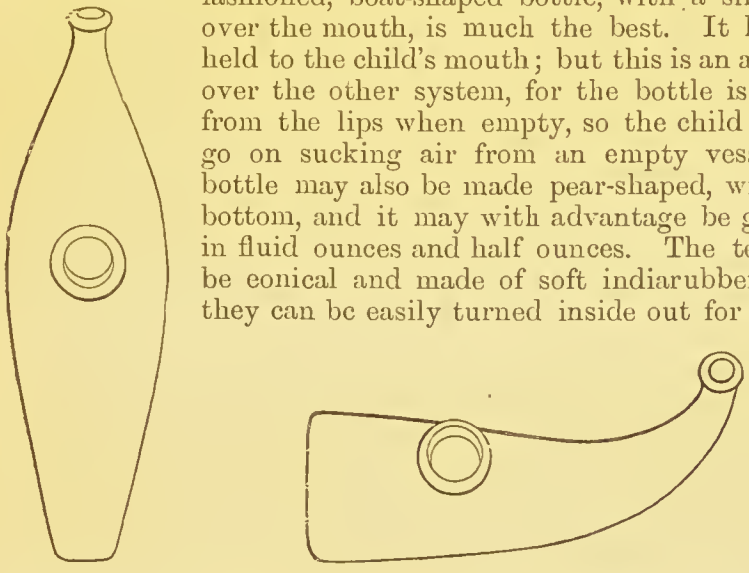

Fig. 16.—Good patterns of feeding bottles.

These are carefully washed inside and out after each cleaning, and kept in the boracic acid solution when not in use. They must be frequently renewed. The apertures in the teat should be large enough to allow a free flow of milk on suckling, but not large enough to allow the milk to flow by the simple force of gravity.

Milk of Animals other than the Cow.—The milk of the goat, of the ewe, and the ass can be substituted for cow's milk.

The milk of the goat may contain as much casein as that of the cow, or more.

The **milk of the ewe** is richer in casein than that of the goat. Hence, the employment of either of these in place of cow's milk would not remove the great difficulty of digesting the casein coagulum. It is, however, of course cheaper to buy and keep a goat than a cow.

The **milk of the ass**, on the other hand, approximates more nearly to that of woman in composition. Compared with human milk, it is wanting in sugar and fat, and has no decided excess of casein. It has often been used successfully as a substitute for cow's milk for a while. It should be given warm from the udder. It is said to be somewhat laxative.*

We have now to pass in review a number of other kinds of foods, natural and artificial, and examine their use in the dietary of infancy.

Farinaceous Foods.—The flour of various cereals, of wheat, oats, maize, lentils, &c., in the form of baked flour, bread, biscuit, &c., together with arrowroot, rice, sago, and tapioca, form a class of foods which, next to milk, constitute the staple diet in infancy after the normal time of weaning; but, inasmuch as these foods all contain more or less starch, it follows from what has been already said that their use is to be avoided during the first six months of life, lest the digestive organs be upset, and the intestines filled with undigested and fermenting products (see pp. 13, 14). Take this as a general rule—No starch for six months.

Predigestion of Starchy Foods.—An important new de-departure in infant-feeding was initiated by Liebig. The natural digestion of starch by conversion into grape sugar can be imitated outside the body by the action of malt. If malt meal be mixed with wheat meal, and kept at a certain temperature, the starch changes to dextrin, then to maltose, then to glucose (grape sugar). Hence, there are in the market to-day a large number of malted foods in which the starch is more or less completely predigested. Infants are thus enabled to take foods of this class long before they could take ordinary starchy foods. Moreover,

* French authors mention the possibility of direct suckling by an animal. The goat is said to be the best for the purpose, because it becomes more or less attached to the nurseling, and will straddle the cradle and present the nipple. The sheep, ass, and cow have also been employed. Families may be advised, it is said, to take an ass and her colt into the establishment for this purpose, if they are willing to disregard the annoyance involved (!) (*Tarnier*, &c., *op. cit.*). It is said that animals with distended udders have occasionally shown a spontaneous tendency to give suck to human foundlings, and that even the classic legend of the nurture of Romulus and Remus by a wolf is not beyond the bounds of credibility.

such foods are not without a small amount of nitrogenous material. The following question now arises:—Granting the digestibility of malted foods, is predigested starch a proper food for early infancy, and is it to be used as a substitute for milk, or merely as an adjunct? We are not sure that the exact value of predigested starch in infant-rearing is yet finally determined, but this at least is certain—Such food is not suitable to be used as the sole diet of an infant. In such a diet there would be a deficiency of fat and of nitrogenous material, and also of the antiscorbutic element. But as an adjunct, when these other elements are also present, foods prepared on Liebig's plan have a great value. No doubt, advertisements of patent foods to-day exhibit photographs of living skeletons subsequently converted into plump and thriving infants by the use of Messrs. A. & B's. preparation, but these advertisements usually omit to assign credit, first, to the discontinuance of the previous bad regimen, and second, to the cream and diluted milk with which the patent food was most properly mixed.

It is when a child, who is being artificially fed, does not thrive on milk diluted and "humanised," prepared by one or other of the methods already adopted, that then the cautious addition to the diet of some form of patent infant's food proves the value of such preparations as those of Messrs. Mellin, Benger, Savory & Moore, Allen & Hanbury, Neaves, and others. It is only fair to acknowledge the care and skill with which these are produced. At the same time, the physician must always have a lingering regret at prescribing any preparation when any detail of its composition or mode of production is unknown to him. If we are to prescribe prepared foods, we should prefer that the British Pharmacopœia should give a choice of reliable preparations, and thus rescue us from the unscientific position of choosing food in the dark. Patent foods of this class vary in the extent to which the starch is converted. If a small quantity be boiled in a test tube, and a drop of tincture of iodine be added, some will strike a deep blue with the starch which is still unaltered. If the starch be completely dextrinised there may be a reddish colour, or no change at all. The more perfectly dextrinised they are, the better are they suited for early use.

Use of Farinaceous Foods after Weaning.—The following are some of the ways in which these can be administered:—

Wheaten Flour—Baked.—A valuable and popular food; it may also be used as a supplementary diet after six months. It is baked in an oven until it is light brown, then reduced to fine powder with a rolling pin, and is administered with a due pro-

portion of milk. All flours are baked before use in order to cause partial conversion of the starch.

Entire wheat flour (Chapman's) is rich in phosphates and nitrogenous matter, and is very useful after weaning. It is a good diet to recommend for rickety children.

Flour Ball.—This is a preparation recommended by Eustace Smith and others, and said to agree especially well from six months onwards. Take a pound of pure wheat flour and tie it up very tightly in a pudding cloth. Boil for ten hours in water; at the end of this time there is produced a yellowish-white ball. When cold, the softer outer coating is cut off, and the hard core is grated to a fine powder. A child of six months can take in twenty-four hours two teaspoonfuls or less of this food. It is given twice in the day. A teaspoonful of the powder is made into a smooth cream with a little milk, and is then mixed carefully with a quarter of a pint of boiling milk poured slowly upon it with constant stirring.*

Wheaten bread can be used early if properly prepared.

Churchill's bread jelly is perhaps the form in which it can be used first. It involves some trouble in preparing, but it is useful in feeding infants who vomit ordinary milk.

Mode of Preparing Bread Jelly.—Take 4 ozs. of stale bread. Soak in cold water eight hours, then squeeze out water, and boil the pulp in a pint of fresh water for one hour and a-half. Strain and rub through a fine hair sieve the thick gruel thus obtained, and allow it to cool into jelly. For use, mix one teaspoonful of jelly with 8 ozs. of previously boiled water, making a thin cream-like fluid, and add a little white sugar. The jelly keeps badly, and must be made night and morning. In this process the starch is partly changed to dextrine and grape sugar. Dr. Cheadle has shown that an admirable substitute for cow's milk can be made by preparing a mixture of 1 part bread jelly, and 8 parts water, 3 parts raw meat juice, and 1 pint cream, with a little sugar.

Bread and Milk for an Infant at Six Months (Chavasse).—Boil the crumbs of bread for two hours in water, taking care to avoid burning, add a little sugar, and a little boiling milk. The proportion of milk to be increased according to age.

Another Plan.—Cut thin slices of bread into a basin, cover the bread with cold water, place it in an oven for two hours to bake. Then remove it and beat up the bread with a fork, and slightly sweeten it. (Milk or cream to be added.)

In very common use are rusks, "tops and bottoms," and other

* Eustace Smith, *Wasting Diseases of Children.*

similar manufactured biscuit foods. These are, of course, to be avoided in early infancy, but are useful after weaning. They need thorough soaking and softening in boiling water. Then beat to a pulp with a fork and strain off water. Add previously boiled milk, or milk and water, and stir to thin uniform consistence.

Oatmeal.—Is useful to mix with wheaten flour before baking. It is laxative in its tendency, and helps to correct the occasional constipating effects of ordinary baked flour.

Oatmeal Gruel may be used to dilute milk, in the same way as barley water.

Barley.—Barley meal is very nutritious, and is largely used in fattening animals. Malt and maltine play a large part in modern therapeutics; but barley itself is not much used for infant diet, except in the form of barley water, which is only slightly nutritious. Barley water for milk dilution is made by taking half an ounce of pearl barley, washing it, and boiling it slowly in a pint of pure water until it is reduced to two-thirds of a pint. Then strain through muslin.

Dr. Eustace Smith includes pearl barley jelly in the dietary for infants of about ten months and onward.

Pearl barley boiled for six hours forms on cooling, after the water has been strained off, a jelly which dissolves readily in warm milk.

Maize or Indian Corn, sold as "corn flour," of which Messrs. Brown & Polson make a reliable preparation. Useful as a variety in diet in second year of age. Is decidedly nutritious, and comparatively rich in fatty matter.

Lentil Flour is nutritious, and is relatively rich in nitrogenous matter. It is sold under the name of Revalenta, and is, as a rule, well taken by infants.

Arrowroot, Rice, Sago, Tapioca, Tous-les-mois.—These contain a large proportion of starch. They are not suitable for staple diet, even when the powers of digesting starch are established; but they are very useful adjuncts to the diet in the second year of life and onward.

Arrowroot, however, can sometimes be taken well by infants with delicate stomachs, and with tendency to diarrhœa. It is made with boiling water and added to the milk.

Potato is very rich in starch. It has also antiscorbutic virtues. Potatoes well mashed, and given with gravy, are useful as the dietary in the second year, or even at the end of the first. Dr. Cheadle advises a gruel made from potato pulp for the treatment of scurvy.

Meat.—Ordinary meat, cut up with the knife, is not suitable for children until their teeth are all cut, and therefore hardly comes into the dietary of infancy. But the gravy, broth, or juice extracted from meat contains nitrogenous matter in a form easily assimilated, and is of great service in infancy both in health and disease. Gravy with potato, broth, and beef tea should be part of the diet in the second year, and broth and beef tea may often with advantage be given two or three days a week in the last two or three months of the first year.

But we often have to do with emaciated half-starved infants who are vomiting their food, and are brought down by diarrhœa, and who cannot take milk, or with those who are threatened with scurvy or rickets, or who are suffering from great deficiency of nitrogenous material in their present diet; and it is here that certain preparations made from meat have a very special value.

Beef tea, chicken broth, and mutton broth whilst useful for diet in health, have, as is now well known, a comparatively low nutritive value, and for the conditions just mentioned are very inferior to the juice or pulp of raw meat.

Raw Meat Juice.—This is rich in nitrogenous material, is easily digested, and is antiscorbutic. It must be absolutely fresh, and be prepared twice daily at least. According to Dr. Cheadle, the best way to prepare it is as follows:—

Mince finely the best rump steak, then add 1 ounce of cold water for every 4 ounces of meat. Stir well and let it stand for one hour. Then forcibly express the juice through muslin by twisting it. This juice contains 8·2 per cent. of nitrogenous matter, which is nearly double the amount in cow's milk, and nearly three and a-half times that in human milk. One or two teaspoonfuls of this may be given every two or three hours according to the age of the infant, combined with other food.

Raw Meat Pulp may be prepared by scraping the soft muscle element from the fibre and administering it raw to the child. It can also be made by finely mincing the meat and pounding it into a pulp in a mortar.

The pulp so produced is strained through a fine sieve or a piece of muslin, to remove the blood vessels and cellular tissue. The dose will be one teaspoonful, given from four to eight times daily. A little sugar may be added to the pulp to make it more palatable to the child (*Eustace Smith*).

In all these preparations boiling is to be avoided. This would coagulate the albumen. One fear will naturally occur to the physician—does the administration of preparations of uncooked

meat involve any danger of tape worms, or of other parasite? The risk cannot be denied. It is not very great, and is not to be weighed against the advantage gained from these preparations in a case of serious malnutrition. Perhaps the juice may be safer than the pulp.

Preparation of Predigested Meat.—Since it has been recognised that ordinary extracts of meat fail to contain the principal nutritive elements, various preparations have been introduced which contain peptonised meat. These can sometimes be used in this same class of cases, as a temporary diet, for they contain more or less of the fibre of the meat dissolved, and not simply the extractives. Messrs. Wyeth, Carnrick, Benger, the Kreochyle Company, and others supply such preparations. Their use as a permanent article of diet would be open to objections similar to those applying to the permanent use of peptonised food in general. We do not know how far their antiscorbutic virtues are established.

Eggs.—Hard-boiled eggs are always unsuitable. Lightly-boiled eggs, especially the yolk, are admissible in the second year, and the uncooked yolk beaten up in milk is also useful to add nitrogenous material to the diet in the latter part of the first year. The yolk of egg also contains a considerable proportion of fatty matter.

UNSUITABLE FOOD FOR INFANTS.

Those who have to deal with the class of people attending hospitals, or who visit amongst the poor, know that negative advice is needed as much as positive in regard to infant-rearing. When the infants regularly share with the adults whatever is put on the table, the consequences are naturally disastrous.

Tea and coffee must not be given to infants or young children. Alcoholic stimulants must be entirely avoided, except under medical orders, and, in particular, gin and spirits must not be given for flatulence and indigestion.*

In a popular work on this subject by Mr. Howard Barrett, there is given the following list of articles to be avoided in the diet of young children :—

* See paper by Dr. Moore Madden on "Alcoholism in Childhood," Brit. Med. Association at Dublin, 1884 (*B. M. J.*, August 23, 1884), and discussion upon the same, especially remarks by Dr. T. Barlow, for evidence as to ill effects of alcohol on childhood and infancy.

ARTICLES TO BE AVOIDED.

New or heavy bread, hard boiled eggs, potted meats, &c., all rich and highly seasoned soups.

Meats.—Pork, veal, bacon, salt beef, duck, goose, sausages, liver, kidney, heart, tripe.

Fish.—All shell fish except oysters, and these only in exceptional circumstances. Salmon, eels, herrings, mackerel, and fresh-water fish generally.

Vegetables.—Cucumbers, radishes, celery, onions, flavouring herbs, mushrooms, broad beans, greens, and pickles.

Excess and rich character of pastry, various sweetmeats, sauces, spices, nuts, cheese, sweet and rich cakes, suet puddings, dried currants and raisins in pudding, and all alcoholic stimulants.

Of course, these are altogether inadmissible in infancy, and yet, when one visits a sick baby in the lower parts of the city, any one of the above is likely enough to be the source and cause of all the mischief.

Having now considered various kinds of foods and preparations of food which afford alternative choice at successive periods of infancy, it will be useful to consider how our selection should be guided in certain cases. The signs that any particular diet is unsuitable may be either symptoms of irritation and indigestion at once, or a more general failure of growth and nutrition when the diet has been tried for some time.

The symptoms of irritation and indigestion are vomiting (especially vomiting of sour ill-smelling food); unnatural and offensive motions and diarrhœa; flatulence and abdominal distension, causing colic, feverishness, constant fretfulness and crying, hot offensive breath, and loss of flesh.

A general failure of nutrition will be shown by the results of weighing, and the thinness, flabbiness, and weakness of the child, which will be unsatisfied with its food, and miserable. Signs of special constitutional disease may also develop (see Chap. II.).

DIET OF AN INFANT FED ARTIFICIALLY FROM BIRTH.

The best plan is to begin with some form of "humanised" cow's milk. This must be boiled and diluted, as already explained. Probably the safest method is to commence with a **milk, cream,** and **sugar mixture,** using barley water, &c., as a diluent (see p. 63), or with milk humanised according to Dr. Playfair's formula, the utility of which we can strongly confirm. Assuming that there is no sourness or carelessness in the feeding, success will usually attend one of these plans; but if the child

be brought under treatment with its stomach already upset, the above may fail. Also, we occasionally meet with children who seem quite unable to take cow's milk at all.

But we are not at the end of our resources; we may change the source of supply; we may try duly diluted condensed milk; we may employ systematic sterilisation (p. 67); we may peptonise the milk, or give peptonised condensed milk, or some form of patent milk food; we may eliminate the casein for a while, as in the whey and cream mixture; or the milk of the ass may be employed, or even that of the goat, treating it by dilution, &c., as with cow's milk.

If all this fails we may employ Dr. Cheadle's prescription of "bread jelly," cream, and raw meat juice (p. 74).

Also, the question of obtaining a wet-nurse for a while should be considered.

Having found a form of food which the child does not vomit, we have to watch to see whether the child is thriving properly. More cream may be needed. If we are partially excluding casein, more nitrogenous food may be required, and some form of meat juice may at times be the best supplement. And, again, to supplement diluted milk with some kind of malted food when the child is not thriving may render help. We have spoken plainly about the abuse of farinaceous food, but we cannot hold that it has no use at all in early infancy. In such a case as we have supposed, say at the age of three months and onwards, once or twice a day from 30 to 60 grains of Mellin's food may be given, and later on some less highly dextrinised food may be used with advantage. Always watch for signs of irritation and indigestion when any change is made in the diet. With similar care we must always seek to accustom the infant gradually to dispense with predigested foods, and to take food in its natural state. At the sixth month we may expect the infant to be taking 2 parts milk and 1 part water, with half a part of added cream, and twice a day, if necessary, some appropriate farinaceous food, malted or not, may be added to this.

DIET AT TIME OF WEANING.

After what has been already said we need not add much under this head. Begin with well diluted milk and barley water, or milk, cream, and sugar mixture, or some diet appropriate to an age somewhat younger than the one at which the child is weaned. Increase the strength of the food gradually, carefully watching for signs of indigestion or irritation. Humanising and

predigesting the milk will be methods available to make the transition in the diet. Carefully watch the weight of the child.

We have already indicated the principal scources from which the food of the infant is taken after the time of lactation is over. We will next give some general principles for constructing a dietary during the remainder of infancy.

QUANTITY OF FOOD IN TWENTY-FOUR HOURS.

No absolute rule is possible. The amount varies with age, with weight, and with the digestive capacity of the child. On p. 52 we have given some observations on the amount of breast milk taken. On the whole the amount of artificial food will exceed this. By the end of the first month the child will take an amount which may be as little as 12 ozs. or as much as 20 ozs.—that is, it will be fed about nine times in twenty-four hours, with 1½ to 2 ozs. each time; in the second month it will take from 20 to 30 ozs.—*i.e.*, 2½ ozs. to 3 ozs. per meal; in the third month about 30 ozs.; during the fourth and fifth month this may increase to about 40 ozs.; so that, at the beginning of the sixth month, the child will be taking six or seven meals of 5 or 6 ozs. each.

After this, the amount will gradually increase till it reaches 3 pints at the commencement of the second year. During the second year the quantity remains the same in bulk, but the solid constituents may be increased.

DIETARY AT ABOUT NINE OR TEN MONTHS.

Five meals in the day.

First Meal, about 7 or 7.30. This should consist of about 8 ozs. of boiled milk, with the addition of some farinaceous food prepared in one or other of the ways already described. For example, a choice may be made of bread, baked flour, flour ball, entire wheat flour, revalenta, barley jelly, barley biscuit, &c., and if these do not agree, some kind of malted food may be temporarily substituted.

The Second Meal, given about three hours later, may be a lighter one, and may consist of about 6 ozs. of milk, which should be previously boiled, &c., should not be given quite undiluted, and which may need some alkali or barley water to assist digestion.

The Third Meal is given at the time of a mid-day dinner, say 2 p.m. This meal should contain some nitrogenous food, for

example, about 6 ozs. of beef tea may be given with a rusk, or the yolk of an egg beaten up in milk. Do not forget a pinch of salt.

The Fourth Meal, about 6 p.m., should be a repetition of the first.

The Fifth Meal, the last thing at night—*i.e.*, 10.30 or 11—is a repetition of the second.

AT ABOUT TWELVE MONTHS TO EIGHTEEN MONTHS.

The First Meal, much as before. Bread and milk varied with farinaceous foods made with milk, occasionally the yolk of an egg beaten up. Fine oatmeal also useful.

Second Meal.—Milk as before. A little thin bread and butter or biscuit being added.

Third Meal.—Amount of nitrogenous food gradually increases. Gravy and potatoes, gravy and bread crumbs, egg yolk and milk, beef tea and broth. May be followed by a "second course" of some light farinaceous pudding—sago, rice, tapioca, &c.

Fourth Meal.—First repeated.

Fifth Meal.—A simple drink of milk. Do not increase this, as it will be discontinued shortly.

FROM EIGHTEEN MONTHS TO TWO YEARS.

Four meals daily are usually sufficient. The fifth meal may be discontinued, and the child will very likely sleep from 6 p.m. to 6 a.m. The solids of the diet can be increased, a little cooked meat, minced and pounded, can be taken occasionally, or a little boiled fowl or fish. The amount of potato, bread and butter, and farinaceous puddings can be increased. A little fruit, stewed or preserved, may be taken occasionally.

DIET FOR RICKETS.

In case of a child who shows a tendency to develop rickets, it is necessary first to discover anything in the diet which may be upsetting the child's digestive organs, and to seek by appropriate treatment, medicinal and dietetic, to cure any gastro-intestinal catarrh that may be present.

Next, one must find out, if possible, whether any essential element is deficient in the diet. Generally speaking, the fatty

element must be increased, cream especially must be added, and good fresh milk must be secured and prepared as may be necessary by one or other of the methods already described. The nitrogenous element must also be supplemented, and one of the preparations of meat juice may be resorted to. The well-known remedies, cod-liver oil, iron, and phosphate of lime may be employed also, but are no substitute for dietetic measures. For the general treatment of the disease we must refer the student to ordinary text-books. We may, however, remind him always to investigate the history and symptoms of the child with regard to a possible syphilitic taint, in which case a course of grey powder will often help the cure very considerably.

DIET IN SCURVY.

This can be gathered from what we have already said. Fresh milk, raw meat juice, potato gruel, orange juice, grape juice, or lime juice, are the most available anti-scorbutics. Some iron and cod-liver oil may assist the cure.*

DIET IN CONSTIPATION.

It is always best to relieve constipation, if possible, without resorting to drugs. In breast-fed infants it is sometimes sufficient to alter the diet of the mother, and to give her laxative food, such as oatmeal porridge and treacle, stewed fruit, baked apples, prunes and figs, &c.

In the case of a hand-fed infant an increased dilution of the milk, and the use of barley water or oatmeal gruel as a diluent, will sometimes answer. Brown sugar and small quantities of honey may be used instead of white sugar for the food, and a teaspoonful of strong simple syrup may be given in the morning. More cream, too, should be given when weaning time comes, and oatmeal may be added to the bottle. Some of the malted foods also are laxative, when unconverted starch is found to be binding.† When the second year is reached oatmeal

* In the pharmacopœia of the Great Ormond Street Hospital for Sick Children is a formula prescribing equal parts of iron wine, cod-liver oil, and glycerine. Infants usually take this well, and often seem to relish it greatly.

† "In the first few weeks of bottle-feeding constipation is very common, and may be effectually remedied by placing as much phosphate of soda as will lie on a threepenny piece in the bottle, two or three times in the twenty-four hours" (Playfair). See also Cheadle's "Lectures on Constipation in Infancy," *Lancet*, 1886.

can be given more freely. Treacle can be added to puddings, and baked apple pulp can be employed. To promote regularity in the action of the bowels (see p. 52) is a very great preventive of costiveness, and systematic massage of the abdominal wall in young infants will often help.

DIET IN DIARRHŒA.

Infantile diarrhœa will be found to be treated of at length in all books on medicine in general, and children's diseases in particular. Here we will only remind the student to consider the following questions :—If the child be suckling, examine the diet and health of the mother; also see whether the child has thrush. If the child be bottle-fed, examine the bottle and the food. If it does not seem to be a case of decomposing food, or of excess of casein, or of wrongly constituted dietary, consider the source of the milk, the food of the cow, the water supply and sanitary condition of the house. If it be a question of irritating diet, remove the offending element and simplify the diet, but do not starve the child. After removing the cause, well judged *drug* treatment is a very great help.

CONCLUDING NOTES ON DIET.

1. There is no *one* formula for infant feeding. Infants have their likes and dislikes and peculiarities as well as adults. What will succeed with one will fail with another. Variety is necessary; but new articles of diet must be introduced one at a time and the effect noted carefully.

2. Food should be given at a temperature of about blood-heat, say 95° to 100° Fahrenheit.

3. It must be freshly prepared, and what is left over must not be kept for a later meal. This is especially true of all milk-containing food.

4. In artificial feeding, remember that salt is necessary for diet in infancy.

5. Over-feeding is a very common error, and a reduction in the amount of food, or a return to a simpler diet, will often be followed by marked improvement when restlessness, flatulence, and indigestion trouble the growing infant.

6. Do not hurry the child over its meal, rather intersperse the meal-time with pauses. The more solid the food, the more slowly it should be swallowed.

7. In using a bottle, be careful to avoid any sucking after the

bottle is empty. This fills the stomach with air. The bottle may be discontinued at the end of the first year, and the child fed with the spoon.

8. Give great care to the cleanliness of the vessels in which milk and other food are kept. Remember how much better milk keeps in a cool place.* Food should not be kept in the nursery any more than in a sick room. The use of a refrigerator for keeping milk and other food will be found very serviceable.

Dr. Cheadle points out the obvious risk of keeping food warm in the bedroom all night. It should not be warmed till it is needed.

9. Remember that fine subdivision of food is essential for its digestion. Infants cannot masticate. Lumps of curd, pieces of meat, and of vegetables are exceedingly likely to produce indigestion.

10. It is a mistake to suppose that it is better to feed a child wholly artificially, than to feed partly with mother's milk and partly with properly prepared cow's milk. Supplemented suckling is better than weaning.

11. The supposed advantage of obtaining milk from one and the same cow is not now upheld by much authority. There may sometimes be good reason for avoiding particular cows, but not for depending upon them exclusively.

* Soxhlet says that fresh milk turns sour and curdles as follows :—

At 32°	C. (90°	F.) in	19	hours.
25°	C. (77°	F.) in	29	,,
17·5°	C. (63·5°	F.) in	63	,,
10°	C. (40°	F.) in	208	,,
0°	C. (32°	F.) in	3	weeks.

CHAPTER IV.

ON THE GENERAL HYGIENE OF INFANCY.

Cleanliness, Ablution.—An obvious difficulty attends the maintenance of cleanliness in infancy. The genital organs and the adjacent parts of the thighs and buttocks are continually soiled with urine and fæces. These are apt to cause redness and sorcness of the skin, especially when the excretions are irritating in their nature and where the infant is weakly. Under such circumstances the irritation may reach a very high degree, the parts becoming red, hot, swollen, and painful. Every sick-nurse knows that when in an adult patient incontinence of urine and fæces set in, similar difficulties have to be contended with. The great preventive is cleanliness. The diapers must be changed as soon as they are soiled, and the parts carefully washed and thoroughly dried. The child must also have a bath each day, and a strong healthy child may be bathed twice daily. Avoid bathing immediately after a meal. The temperature of the bath must not be merely judged and guessed with the hand, for the sensation of heat and cold to the hand is fallacious, but a bath thermometer must be used. The temperature should be about 90° F. (or 32·2° C.), and the water must not be too hot, for an infant's skin is very tender. Do not let the temperature of the bath exceed 95° F. Prolonged immersion in the water is not desirable at first, and in the case of delicate infants may be as brief as possible, or be omitted altogether, and sponging substituted. Soap with much soda in it is apt to irritate the skin. Glycerine soap is free from this objection, and Castile soap is also good. It should be remembered that sponges harbour dirt, and that it is difficult to clean them thoroughly. If the child have any excoriated surface, a dirty sponge may do serious harm. In drying the child the greatest care must be taken to cleanse the folds of the skin, the genital organs, the armpits, the back of the ear, and the creases in the neck. Carelessness in this respect is a great cause of chafing and soreness. A soft towel must be used. The powdering of the skin with starch powder is a common and useful practice, but when there is redness or chafing, something of a greasy nature acts very well, and the

boric (or boracic) ointment of the British Pharmacopœia is exceedingly useful for this purpose.

The first washing of the child presents no difficulty. The vernix caseosa must be carefully wiped off with sponge or flannel. This process is facilitated by greasing with lard, oil, or vaseline.

When a child is ill it is often better to suspend the bath, and substitute sponging. The bath should be given at a regular hour.

In practice amongst the poor we find the **hair** greatly neglected. It is too often matted and infested with lice, and the "nits" or eggs of the louse. The parasite thrives best in weakly children. The lice are killed with carbolic oil (1 in 40). The nits are removed with vinegar and water, or paraffin. Stavesacre ointment, and white precipitate powder or ointment, are also efficient parasiticides. Due cleanliness, however, will prevent the onset of this condition.

Ventilation.—Children cannot thrive in an atmosphere charged with carbonic acid gas, and with air that has been breathed over and over again. There is a very simple and useful test of the freshness of the air of the room. It is to enter the room directly after leaving the outdoor air. Any close, unpleasant odour can then be readily detected. The aim of the nurse is to have the nursery or sick-room so well ventilated that no such odour shall be perceptible. It must be confessed that in England it is not easy to obtain by any one simple method adequate ventilation all the year round, because the external temperature varies so greatly and so suddenly, and the presence or absence of wind makes so great a difference. When there is a fire burning it will usually effectually ventilate the room, for if there is a good up-draught in the chimney the air will come in at every window and door, and even through the walls and the cracks in the floor. If the infant be shielded from direct draught, the opening of the upper part of the window will, under ordinary conditions, be unattended with risk. Ventilation can also be obtained from the window by the following simple plan:—

A piece of wood 2 or 3 inches deep, and as long as the breadth of the window, is made to fit in below the lower sash, which is then shut down upon it. (See *a*, *a*, Fig. 17.)

By this means a space is left between the upper and lower sashes, where the air can enter with an upward current (*b*, *b*). If the blind be drawn down a little way it will help the gentle diffusion of the air. There is thus provided an adequate inlet without draught.

For details of more complicated ventilators, which require fixing by structural alteration, the student is referred to text-books of Hygiene. We may, however, refer to Mr. Pridgin Teale's excellent method of ventilation with air filtration, as described in his work on *Dangers to Health.*

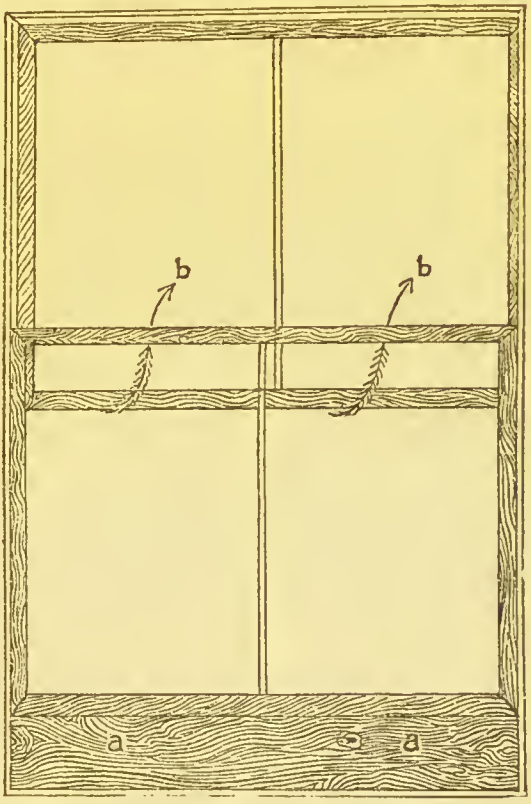

Fig. 17.—A simple form of window ventilator.

Every day the sleeping-room must be thoroughly flushed out with fresh air, by opening the windows top and bottom. The same thing must be done in the day-room, and then the child must not be brought into it until the thermometer stands at the proper temperature.

Warmth.—On the need of heat we have already dwelt. But there are methods of obtaining this which are bad. Very hot rooms are to be avoided, and still more rooms which are both hot and close. The burning of gas in open burners in order to heat a room quickly is to be especially condemned; even a gas stove with a good up draught into the chimney cannot be re-

commended for nurseries, but one without a chimney is an utter abomination.

A room which becomes very hot at one part of the day is almost certain to be much colder at some other part. Such variation of the temperature, especially when combined with vitiated air, is a great cause of colds and bronchitis. Mothers sometimes express great perplexity as to how an infant can have taken cold. If the nursery be overheated, and the air

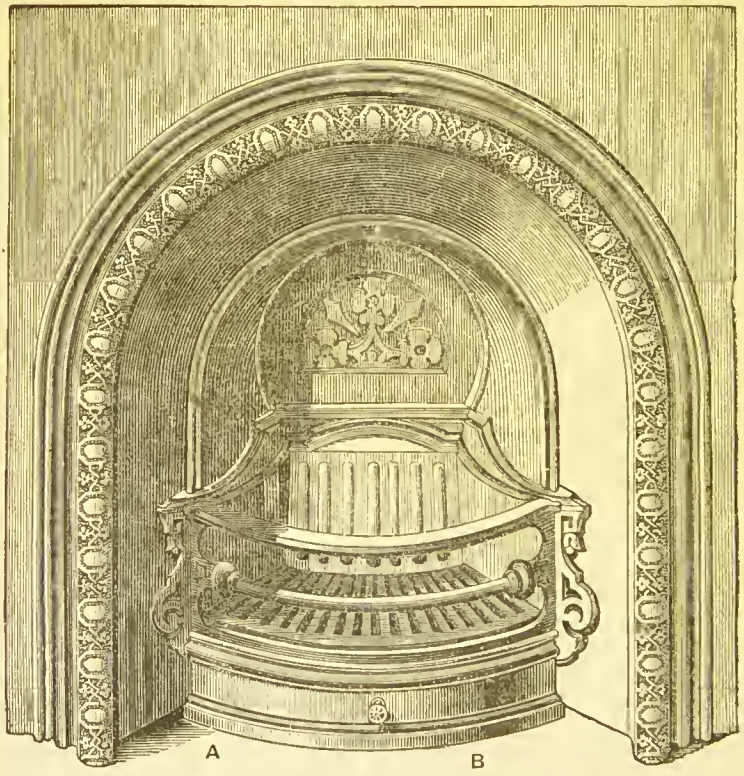

Fig. 18.—Ordinary fireplace modified according to Teale's principle.

impure, the cause is not far to seek. Hence what is needed is a uniform temperature and a pure atmosphere. There must be a thermometer in the nursery, and this should not stand above 65°, nor below 60°. The thermometer must be hung near the cradle, for currents of air may make one part of a room cooler than another. We must give special caution against the practice of taking an infant from an overheated day-room to a cold bed-room. In the winter evenings the difference between the sitting-

room and the bed-rooms in many houses is as much as 20 or 30 degrees. This is why some adults cough for an hour after retiring to bed, and explains the onset of many cases of infantile bronchitis.

The nursery is best heated by an *open coal fire*, burned on the slow combustion principle.* The following is a plan by which an ordinary grate can be made so to act:—

Fig. 18 shows an ordinary grate. A plate of iron, A B, which is movable, is made to cover in front the space between the lowest bar of the grate and the hearthstone. When this is in its place, no draught comes up between the bars at the bottom of the grate. In consequence of this the coal burns more slowly, less heat is lost up the chimney, and fuel is economised.†

The nursery then must be a healthy room in a healthy house. Children will not thrive in an atmosphere contaminated with sewer gas. They are likely to be pale and sallow, to suffer from vomiting and diarrhœa and sore throat; but the symptoms may be vague and ill-defined, amounting to little more than general sickliness and malnutrition, and may be easily ascribed to anything but the right cause. No householder should take it for granted that the drains are sound because they have once been certified to be so, but should have them periodically inspected; for traps may run dry, become choked, pipes may be damaged or obstructed, and joints may give way. This inspection should, however, be done before the birth of the child. No confinement should be allowed to take place in an insanitary house.‡ The nursery should have ample cubic space. This should not be less than 500 cubic feet per infant, and may with advantage be 800, or as much more as possible. Its aspect should, by preference, be south so as to get the maximum of sunlight. Warmth and ventilation must be attended to. If there be a bath or lavatory basin, or sink, near the nursery it is of special importance that they should be duly disconnected from the drains. Cleanliness must be maintained, and all excreta and stale food, &c., must be promptly removed from the room. Curtains and hangings are to be avoided as much as possible.

* See *The Economy of Coal in House-fires*, by T. Pridgin Teale, F.R.S. (Churchill).

† Grates on this principle are supplied by Messrs. Teale & Somers, of Leeds.

‡ We can recommend as a good practical guide for a householder a book entitled *Is my House Healthy?—How to find out*, by Dr. Spottiswoode Cameron, Medical Officer of Health for Leeds. Also, *Practical Sanitation*, by Dr. Geo. Reid, D.P.H., Medical Officer to the Staffs. County Council, may be recommended to all who wish to go further into the subject.

Carpets become fouled and stained by the accidents inseparable from infancy. Stained waxed floors, with a loose rug which can be frequently shaken, are satisfactory. The "cork-carpets" now sold are warm and washable, and very suitable for nurseries. Whenever possible there should be a day-room and a night-room. This greatly facilitates cleanliness and ventilation.

Light in the nursery is secured by a suitable aspect and by good sized windows. These must be duly protected by bars. Windows that descend to near the ground are to be preferred. If a low table be placed for the child's toys in front of the window, the child can play in the sunlight. The ideal arrangement is to have a bay window with a window-shelf running round it. Children always make for the light, and will revel in such a spot as this. Due protection against draughts is presupposed. For children's nurseries, as for libraries and picture galleries, avoid gas if possible, and substitute candles or lamps. The self-ventilating gas globe, with shaft leading to the external air is, however, very suitable for dwelling-rooms. The objection is the initial cost of fixing. Fortunately, electric lighting is making its way into private houses, and will presently be within the means of most.

The walls should be covered with papers free from arsenic, and these may be varnished to allow of washing, or the walls may be painted, and treated like those of hospital wards.

In furnishing a nursery, everything that can harbour dust and dirt must as far as possible be avoided.

Clothing.—The use of clothing is to promote warmth by preventing loss of heat from the skin. It is far better to maintain heat by this plan than by high external temperature. *Keep the rooms from becoming too hot, keep the child from becoming too cold.*

The first clothing of an infant is regulated by national and local traditional customs to a remarkable extent, and curious and interesting results would be obtained from an extensive study of the subject. In some parts of China, for instance, infants at first lie naked under the bedclothes, and when they are older they are dressed in loose baggy trousers partly filled with sand. This plan provides for the absorption of the excreta, and is considered to have the further advantage that the weight of the sand keeps the child from undue wandering.* In India the children do not wear a rag till they are three or four years old.

*A. H. Smith, *Chinese Characteristics*, Shanghai, 1890. Of one who shows babyish traits, it is said, "He has not yet been taken out of his earth trousers."

In France the use of the *maillot* (swaddling clothes) is common. In England infants are dressed at first in robes of a length and amplitude which are ludicrously disproportioned to the small size of the new-born child. In about three or four months they are suddenly "shortened"—*i.e.*, put into short clothes. After this the clothing commonly errs on the side of insufficiency. It is a common thing to see children with the neck, arms, and legs bare,

Fig. 19.—"Shortened!" *

and the thighs and lower part of the abdomen covered only by short skirts, under which the wind has free access, and which form no protection at all as the child crawls and sits on the ground.

In cold northern climates this exposure, and consequent reduc-

* For this sketch the author is indebted to the pencil of his friend, Mr. R. Fred. Reynolds of Leeds. The subject is treated diagramatically, but the satire is almost without exaggeration.

tion of temperature, is a serious danger. Yet one often sees the children sitting on the pavement or damp grass, with arms and legs blue with cold. No doubt the high mortality from pulmonary and abdominal disease is partly due to insufficient clothing.

The clothing of infants and children must be free from constriction and discomfort. The first clothes of the infant are best made to open the whole distance from top to bottom, and to fasten by folding over and tying the tapes, pins being avoided. This makes it easy to put them on, and the arms will never be strained through being forcibly dragged at an awkward angle into a sleeve. The clothing must not be too heavy.

After the navel is healed, it is not desirable to employ a tight abdominal bandage. There is no sense in constricting the child's body. This is a mistake often made. On the other hand, a band of flannel may be used to keep the chest and abdomen warm in cold weather, but it must be loose. In fact, moderately loose clothing is warmer than that which is worn tight.*

As to material, a woollen fabric of loose texture is the best non-conductor of heat, and it is also soft as an infant's clothes should be. Flannel and Merino are excellent for the purpose, and knitted woollen garments are warmer still, for they contain more air. These may be worn next the skin. It is only occasionally that the skin is so tender that a cotton or linen chemise is necessary. "Flannelette" is made of cotton, and it may have a little wool in its composition, but usually it has none.

After "shortening" the clothing should be ample, and should cover the child from neck to ankle. Long stockings reaching to

* The following plan of clothing a young infant is by Dr. Grosvenor of Chicago, and is quoted from Dr. Yale's article in Keating's *Cyclopædia* :— "There are three garments (besides the napkins), all covering the neck and shoulders, and reaching 10 or 12 inches below the feet. The outer garment as well as the middle one, is a little larger in every dimension than that beneath it, so that no (tight) binding shall take place. They are all cut in the girdleless pattern called 'Princess.' The inner one has sleeves, and may be made of cotton flannel or very soft wool flannel. If wool is used, care must be taken against shrinkage in washing. The next garment has no sleeves, and to ensure against pressure at the arm-holes, has no seams there. The material is wool flannel. The outer one is the usual dress with high neck and sleeves, the details of which may be modified to suit taste. Thus, except the sleeves, the thickness is the same throughout. At night a garment like the inner one above described, and a napkin only are worn. These three are placed one within the other before the dressing commences, pains being taken to avoid wrinkles and folds, and they are put upon the child as one garment with very little trouble. They are removed with equal ease."

the diaper form the best covering for the legs and thighs, followed by flannel drawers, when the diapers are discarded. In addition to the constant change of diapers, a daily renewal of the underclothes is necessary.

Coverings for the Feet.—In a baby's foot we see the natural shape of the human foot. In the adult Englishman or English woman we *never* do. The fect are always more or less distorted by the shoes and boots which we wear. Hence come corns, bunions, ingrowing toe-nails, and inflamed toe-joints in those who are gouty. Never let an infant's feet bc pinchcd by its shoes. Lct these be broad at the toes and soft and yielding in texture. They should be made by taking a tracing of the foot, and constructing according to that pattern.

The author here gives a tracing of the foot of a Scotch lad of about six years of age, taken some years ago on the side of Arthur's Seat in a Scotch holiday. The lad said he had never

Fig. 20.—Tracing from the foot of a lad of six years old who had never been shod.

worn a shoe. Note the manner in which the toes spread, and how the great toe points inwards. The dotted line shows a very moderate estimate of the shape of shoe this lad would have bcen wearing had he been born in England.

Out-door Air and Exercise.—The general rule is to take the infant out every fine day, summer and winter, cxcept when cold east winds are blowing. In summer this may be commenced at the end of the first fortnight, in winter at the end of the month. At first the child should be carried in the nurse's arms. In using perambulators it must be remembcred that a young infant cannot sit up. A feeble infant braced up with a strap in a sitting position in a jolting perambulator is a painful spectacle. Those cradle-like carriages which allow the child to be laid at length are much better. A perambulator is colder than the warm arm and body of the nurse, and this must be borne in mind, and sometimes a hot bottle may be uscd with advantagc in the perambulator. Exposure to thc direct rays of a hot sun is undesirable,

and sunstroke may result from carelessness in this particular. The danger of exposure to cold winds must also be carefully enforced.

Within doors, before the child can crawl, it seems to afford him pleasure to lie on the ground on a rug and kick his legs about; and this may be encouraged. And generally speaking, the child may take the exercise in crawling, standing, and walking that he evidently desires. But it is a mistake to make a child sit, stand, or walk prematurely; when the muscles and bones are strong enough their use will come to them naturally; but if they are weak, and especially if the constitution is rickety, deformity will result from too early use of the legs and spine.

Sleep.—The child must sleep in a cot separately, and not with the mother in her bed. This is to avoid overlying. The cot must not stand in a draught. The bedding should be well aired daily, by open windows and sunshine if possible, and on wet days by the heat of the fire. Above all things avoid a damp bed. This means care, because the child may wet the bed.

A healthy child sleeps most of its time at first. Throughout infancy it should sleep from about 6.30 p.m. to 6 or 7 a.m., with times of feeding as stated on pp. 52 and 80. During the day it should have a morning sleep and an afternoon sleep, each of two hours or more. It is well to keep the child awake for an hour or two before the coming bedtime, so that it may become a little tired and drowsy and so rest the night through.

SPECIAL CARE OF NEW-BORN CHILDREN.

Respiration.—Immediately after birth the mouth and throat must be thoroughly cleansed from mucus and other matter, and, if necessary, the child may be turned on its face for a few seconds to let any fluid run out.

If it does not begin to breathe and cry, the best artificial stimulus is to dash a few handfuls of cold water forcibly upon it, and to slap the buttocks smartly or flip them with a wet towel.

If this fails, commence at once *artificial respiration* on Sylvester's plan. This consists of two movements. Place the child on a pillow, as shown in Fig. 21, an assistant holding the feet. The process is best done in front of a warm fire.

First Movement—Inspiration.—Seize the arms at the elbow, pull them with firm traction above the head, rotating them gently outwards.

Second Movement—Expiration.—Bring down the arms and press them, with elbows bent, upon the chest with firm pressure.

Frequency of Movement.—Fifteen times per minute.

Continue until regular breathing is established, and do not abandon efforts to restore a child till some time after all occasional gasping has ceased, and the heart-beat has become quite imperceptible.

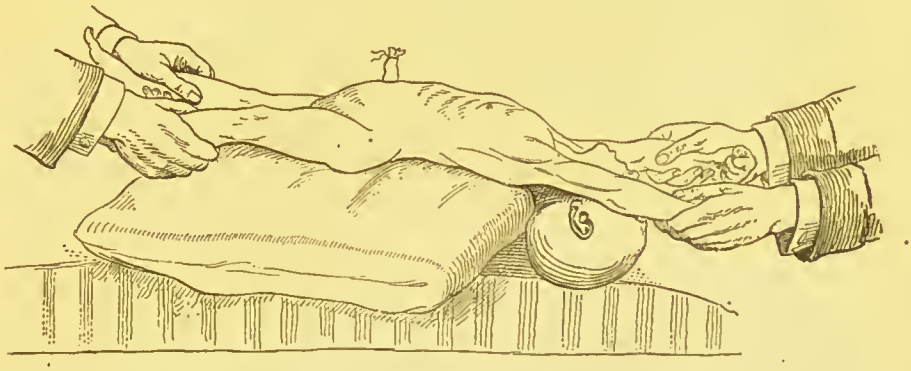

Fig. 21.—Artificial Breathing—Inspiration.

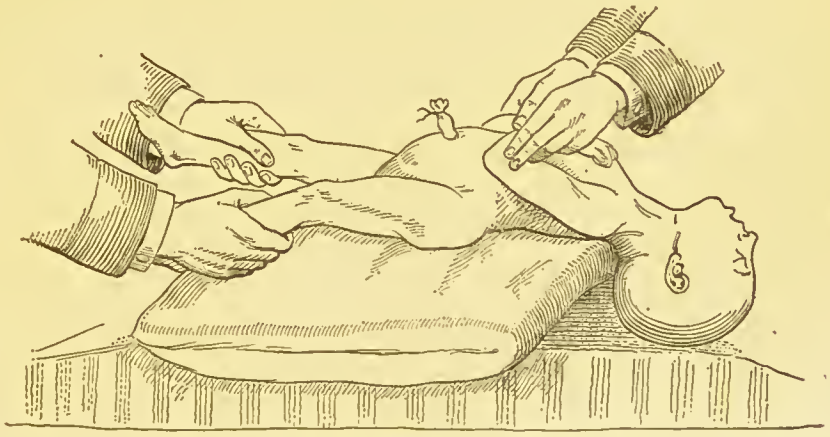

Fig. 22.—Artificial Breathing—Expiration.

Auxiliary Measures.—Have two baths prepared, one at blood heat (100° F.), and one of cold water. Plunge the child into these for a few seconds alternately. If this is likely to do good there will be signs of respiration almost at once; of course the head is not immersed.

There are two classes of these non-breathing new-born children, the blue faced and the pale faced. When the child is blue with semi-suffocation, it is more likely to live than when it is pale, limp, and lifeless looking. If, after the child has breathed well, it relapses into its former condition, the case is serious, for this often means that there is internal injury, especially of the brain.

When breathing continues to be weak and irregular for some hours after birth, we may make use of the couveuse with advantage (see p. 101). In the absence of this we may apply external heat, by laying the child in front of a very warm fire, wrapping it in hot flannels frequently renewed, and using hot water bottles. And the same measures are useful in cases of general feebleness and want of vitality.

Care of the Navel.—There is usually no urgency for tying the cord within a minute of birth. On the contrary, it is a good thing to wait till the pulsation in the cord has ceased for a minute or so (*Budin*). Tie the cord 2 inches from the navel. Do not use a thin silk or other ligature which may cut the navel string. Several strands of worsted make a good ligature, for this is elastic, and will bind the cord tightly even if it shrinks a little, which a thick cord may do. If by any chance the cord bleeds after division, it is easy to put a second ligature on the child's side of the first. To wound the infant elsewhere whilst cutting the cord is an act of unpardonable clumsiness, but it is not an unheard of event.

After the infant is washed, the navel-string is best enwrapped in a square piece of dry boracic lint, which is better than moist or greasy dressing. A piece of clean, dry, soft rag will do if no boracic lint is at hand. It is then secured by a flannel band passed round the abdomen and fastened with a stitch. It is of extreme importance that the navel-string, and the wound which it leaves when it falls, should be kept absolutely free from dirt. Wound infection and blood-poisoning can result from inoculation at the navel wound. Erysipelas and tetanus, for instance, can be so communicated.

There is reason to think that newly-born infants may suffer from illness due to conditions of the navel, more frequently than is commonly recognised. Hence "surgical cleanliness" is imperative.*

* See an artiele by Erös of Buda Pesth, published in the *Archiv für Gynäkologie* (Band xli., Heft 3). "On observations on 1,000 newly-born children in regard to morbid conditions of the navel, and infection of the system produced thereby." The author has published an abstract of this paper in the *Medical Chronicle*, April, 1892.

We may add that any other sore on an infant may be infected by poisonous material. A case has been recently published, for instance, where a mother with a discharging whitlow infected her infant with erysipelatous inflammation, which attacked the genital organs, and spread to the body and thighs.*

The cord must be left to fall off, and must not be subjected to any pulling or twisting. Slight degrees of soreness and ulceration of the navel after the fall of the cord are best treated by a simple plan, which applies to very many superficial sores. 1. Cleanse thoroughly with warm water or antiseptic lotion. 2. Then dress with boracic acid ointment. 3. Cover with a little cotton wool and lint, and retain in place with straps of plaster. This plan keeps out the air and prevents rubbing or chafing. Renew dressings daily.

If bleeding occurs after fall of the cord, this can usually be arrested with a pad of lint or cotton wool, fixed firmly with plaster strapping and a bandage. Occasionally the practitioner may have to apply a styptic, such as powdered alum, tannin, &c. Sometimes the navel protrudes unduly in a young infant, and constitutes the condition called *exomphalos*. This is not a serious matter, for it will almost invariably get well. It should not be treated by fixing a small conical pad over the rupture, for this acts like a wedge and does not hasten cure. Elaborate navel belts are unnecessary. All that is needed is to strap the navel daily with plaster, after the bath, in the following way :—

Draw the abdominal wall together with the finger and thumb, both above and below the navel, so that the protrusion goes in and the navel is pressed out of sight. Then let an assistant apply one or two pieces of strapping from one side of the abdomen to the other, so that the navel is retained when the fingers are withdrawn. A cure will soon be obtained.

Prevention of Thrush.—1. The nurse must examine the child's mouth daily to detect the onset of the disease. Make this inspection while the child is crying during its morning ablution.

2. Scrupulous attention to cleanliness in the teat and bottle is the most essential precaution.

3. The ideal plan is to wash out the child's mouth after every time of feeding, using for this purpose a piece of clean, previously boiled rag, which is destroyed afterwards. The rag is moistened with a solution of borax, about 15 grains to the ounce. In a bottle-fed or delicate child this must be strictly enforced. In a healthy,

* Toujan, *Annales de gynécologie et d'obstétrique*, June, 1893.

vigorous, breast-fed infant, twice or thrice daily is quite sufficient, so long as there is no sign of thrush.

4. If thrush appears, the rag must be dipped in glycerine of borax, B.P., and the white spots must be carefully wiped away as far as possible.

5. The general health of the child must be restored by appropriate treatment.

After the first few weeks the liability to thrush is much less, but at the time of teething, or in wasting disease, it may be seen and must be treated as above.

Prevention of Purulent Ophthalmia.—Under certain circumstances, new-born children may suffer from virulent inflammation of the mucous membrane lining the eyelids and covering

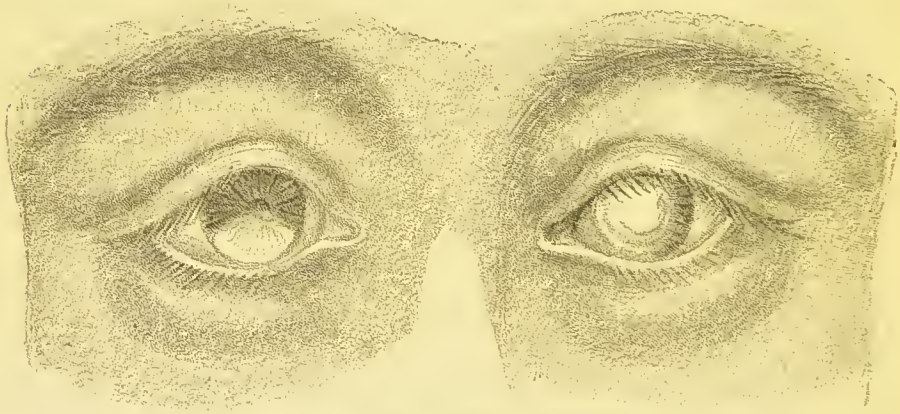

Fig. 23.—Eyes that might have been saved !
(Leucoma from neglected purulent ophthalmia.)

the front of the eye. This becomes red and inflamed, and the eyes discharge thick yellowish-white matter. The consequence of this purulent ophthalmia may be permanent opacity of the cornea, and even destruction of the eyeball. Fortunately the disease, if taken in time, is usually curable, and it is a disgrace to all concerned if, by neglect, the infant becomes blind. (See Fig. 23.)

The disease is due to contagion. The source of the contagion is almost always found in a more or less virulent discharge with which the mother has been affected at the time of delivery. A soiled towel, or sponge, &c., may bring the infection from the eyes of another child, or from some other source, and the nurse might infect her own eye from the child's by carelessness.

The treatment of this condition must be directed by a medical

man, and carried out with the assistance of a nurse. The nurse's duty is in the first place to preserve perfect cleanliness in the eyes of the new born, by carefully washing away with a small piece of cotton wool any mucus or secretion that may collect in the corner of the eye, and to report instantly to the medical attendant the occurrence of the least sign of redness and inflammation on or within the lids. The surgeon will probably make an application to the diseased mucous membrane by dropping into the eye a few drops of a 2 per cent. solution of nitrate of silver. This has a specific action in destroying the micro-organism which causes the disease. He will then prescribe an antiseptic or weak astringent lotion (such as a saturated solution of boracic acid), and the success of the treatment will often depend on the diligence and efficiency with which the nurse washes away the discharge by cleansing the eye, by dropping in the lotion, and wiping away the secretion with pledgets of cotton wool. All such pledgets must be carefully burned.

For full details of the treatment the student is referred to text-books of ophthalmology (*ophthalmia neonatorum, purulent ophthalmia, gonorrhœal conjunctivitis*).

In lying-in hospitals special measures are adopted to prevent the occurrence of an epidemic of this disease amongst the new born.

Credé advised that the eyes of *every* new-born child be at once washed with pure water, and that one or two drops of the 2 per cent. solution of nitrate of silver be dropped from a glass rod between the separated eyelids. This treatment has had a very potent effect in preventing the appearance of the disease in lying-in hospitals, and it is not often that the application has to be repeated.

CARE OF PREMATURE INFANTS.

In Chapter I. we have described the signs which indicate that an infant is prematurely born. Its first disqualification for living is that, whereas under normal conditions it would have remained for perhaps two months more in the womb at a temperature of blood heat, it is brought into the cold external air which it is so ill prepared to resist. This is one great cause of the death of premature children. Another cause of death is the feebleness of its functions, and especially its defective powers of sucking, swallowing, and digesting. A special study of the best method of combating these difficulties has been made by Tarnier and others, and great success has attended their system of treatment.

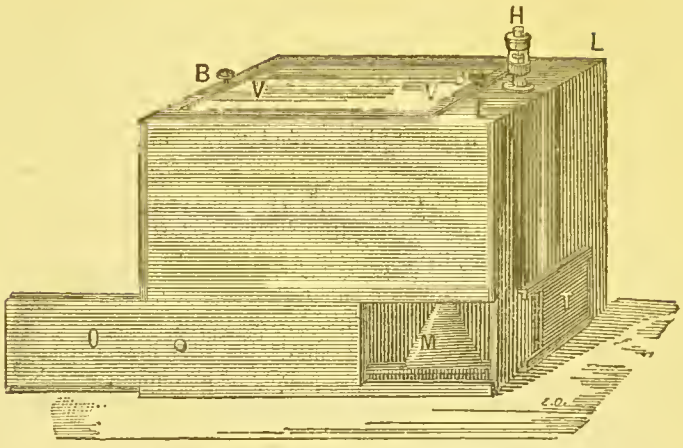

Fig. 24.—Tarnier's new couveuse.

L, Cover of couveuse.
V, Glass pane in cover.
B B, Handles for lifting glass.
O, Sliding door.
M, Hot-water vessel.
T, Ventilation aperture.
H, Gyrating valve.

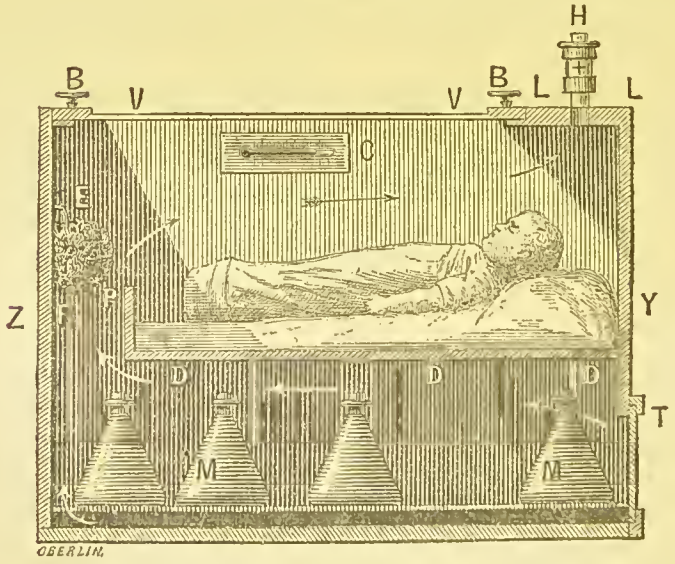

Fig. 25.—Section to show interior of couveuse.

V, Glass pane.
B B, Handles for lifting cover.
H, Gyrating valve.
C, Thermometer.
D, Horizontal shelf.
R, Air passage.
E, Moist sponge in do.
R, Foot of shelf.
T, Ventilation aperture.
Y Z, Walls of couveuse.
M M, Hot-water vessels.

Of this we will now give some account, taken principally from the work of Tarnier, Chantreuil, and Budin already referred to.

The Couveuse.—The deleterious effect of cold on the premature child can be combated by keeping the infant in a kind of warm chamber or incubator. In 1880 Tarnier introduced his first couveuse into the Maternity Hospital at Paris. His second was designed in 1883. It is simple and easily made. It consists of a wooden box 26 inches long, 14½ inches broad, and 20 inches high.

The cover of the box has a glass pane through which the infant can be watched, and a circular aperture about 1¾ inches in diameter, which is the outlet for ventilation, and which usually has a little vane to demonstrate the passage of the air current. The interior of the couveuse is divided into two compartments by a horizontal partition about 6¾ inches from the floor. This shelf does not reach to the end of the box, but leaves space of

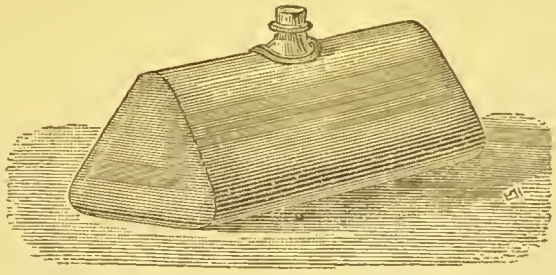

Fig. 26.—Hot-water vessel for warming couveuse.

2¼ inches for passage of air from the lower to the upper division. The infant lies on a little mattress placed on the shelf, the feet being towards the air space by which the two compartments communicate.

The lower compartment is opened by a sliding panel in one side. In one end of this compartment is the inlet for ventilation. This measures 4 inches by 2½ inches, and is partly closed by a sliding cover, which can thus regulate the amount of air. It can be opened to the full extent, but can never completely close the inlet. A thermometer is placed in the upper compartment, and a wet sponge or a small basin of water is put in the air space.

The couveuse is warmed by means of stone bottles or cans of hot water. They are 8 inches long and hold ½ litre each (0·88 pint). The chamber will hold five water bottles, but four are enough to keep the temperature between 31° and 32° C. (87·8° and 89·6° F.), when the room outside is about 60° to 64½°.

To use the couveuse, commence by inserting three cans of boiling water. In half an hour the chamber will be warm enough to receive the child. The child is swaddled in French fashion; but, with a very weakly infant, cotton wool may suitably be used at first. In two hours insert a fourth bottle, and after that one bottle, the coldest, must be changed every one and a half or two hours.

Every hour, or every second hour, according as the case demands, the lid is removed, and the child is taken out to be fed or to be changed. While it is advisable not to expose the child to the air longer than is necessary, experience has shown that there is no special tendency in the child to take cold in such brief removals. This artificial incubation is usually continued for from one to two weeks, but it has been prolonged for forty days.

Indications for the duration of incubation may be gathered from the condition of the child. If he sleeps tranquilly in the couveuse, let him stay there. If he cries while in the couveuse, but is quiet when removed, he may be kept out, but should be replaced if he grows weak. Sometimes after a sojourn in the couveuse, the infants become torpid and cease to gain weight, but will improve in condition and weight if the temperature be reduced to 27° or 25° C. (80·6° to 79° F.).

When incubation is to be discontinued, the temperature must be gradually reduced to that of the surrounding apartment.

The results obtained from the couveuse are very satisfactory in the case of premature infants; and the same treatment is also beneficial in the case of weakly full-term infants who suffer from cyanosis, &c., when twenty-four hours' incubation is often enough. Very much benefit has also been obtained in cases of scleroma.

Auvard says that before the couveuse was used, the mortality among infants weighing less than 2,000 grammes (4·4 lbs.) was 66 per cent., and that this has now been reduced to 36·8 per cent. by its employment.

Gavage, or Forced Feeding.—In 1851, Marchant of Charenton proposed to feed with an œsophageal tube new-born and premature infants, who were too weak to suckle properly. Fabbri was successful in treating foundlings in this way, and published papers in 1865 and 1870, and Beluzzi and St. Germain also followed the plan with success. In 1884, Tarnier commenced to employ gavage for new-born infants, who could neither suck nor take the spoon. The apparatus necessary is a small œsophageal tube, or red gum catheter, and a small funnel or graduated glass receiver (see Fig. 27).

The tube is No. 14 or 16 French catheter gauge. The distance from the infant's lips to the stomach is about 15 c.m. (or 6 inches). To feed the child it is taken on the knee, with the head slightly raised. The tube lubricated, introduced over the base of the tongue and passed into the œsophagus. The child will make a reflex movement of deglutition which assists the passage of the tube. The funnel is then filled with 8 grammes of milk (about two teaspoonfuls), the tube being first compressed. Then the milk is allowed to gravitate into the stomach. The tube is withdrawn rapidly in order to prevent regurgitation.

Fig. 27.—Apparatus for forced feeding.

Eight grammes every hour is the quantity of milk used for a feeble premature child. Mother's milk is the best, and all possible precautions must be taken to secure cleanliness and asepsis. There is one danger in gavage. If too great an amount be used the child quickly gains in size and weight, but this is chiefly due to œdema of the whole body. This will disappear when the amount of food is reduced. If it be not reduced the œdema will be further complicated by gastritis and enteritis, to which the child may succumb.

Hence to succeed, milk must be given in small quantities at each meal, and the number of meals duly regulated.

In the case of new-born children who suckle badly and do not thrive, an alternation of suckling and gavage can sometimes be adopted with advantage. A similar alternation affords the best way of passing from the use of gavage to ordinary lactation. By the simultaneous employment of gavage and the couveuse children born at the sixth month of pregnancy have been reared. For illustration we may mention three cases given in the work referred to where (1) an infant of six months and one week who weighed 1,500 grammes; (2) an infant of six months and one week who weighed 1,100 grammes; and (3) an infant of

six months who weighed 1,180 grammes, were successfully reared.

Phimosis.—The prepuce in the male infant should be capable of complete and easy retraction, and it is important that within the first month complete retraction should be made. If this be neglected, there may be a collection of secretion beneath the prepuce, and the prepuce may become somewhat firmly adherent to the glans. When the prepuce cannot be retracted, the condition is called *phimosis.* A long list of serious evils has been attributed to this condition. Amongst the most certain we may mention local uncleanliness, irritation, and inflammation, nocturnal incontinence of urine, and a tendency to the production of bad habits and moral evils in boyhood and youth ; also hernia, bladder symptoms, falling of the rectum, and certain nervous conditions. It must, however, be remembered that a certain degree of phimosis is natural in the male infant. If the prepuce be drawn back with the fingers, and adhesions broken down, and if subsequently it be retracted systematically, in many cases there will be no further difficulty.

But mere dilation will by no means always succeed, and a long pendulous prepuce is in itself an evil, and in many cases it is best to have the child circumcised by a surgeon. The old rite of circumcision had a sound hygienic basis, and the operation is often performed with great advantage in the present time.

Inguinal Hernia, or rupture in the groin, is sometimes seen in male infants. It is due to the fact that the passsage by which the testicle descended has not yet closed. If a proper truss be applied at once, permanent cure will probably be obtained. Trusses covered with waterproof material are made for infants. The idea that the child is too young to wear a truss is most erroneous. Before applying the truss, make sure that the swelling is not an undescended testis.

Cleft Palate.—When infants with cleft palate are unable to take the breast because the malformation of their mouths prevent proper suction, there may be some difficulty in feeding them.

Sometimes they can be successfully fed with the spoon, the child being supported in an upright position for feeding; also compressing the nostrils may assist swallowing. Or we may employ a very large teat which, when placed in the mouth, will obstruct the cleft in the palate. The apertures in the teat are made in the lower side of the teat, so that the milk flows into the mouth. An ingenious and simple appliance is described by

Mr. Oakley Coles, in his work on "*Deformities of the Mouth.*" * It is made by attaching to an ordinary indiarubber teat a flap of indiarubber, which shall fit against the palate during sucking. This is said to succeed sometimes, but it does not seem to enable the child to take directly the mother's breast milk.

Fig. 28.—Nipple with false palate.

We show a form of nipple for cleft palate sold by Messrs. Maw. The flap may be made larger or smaller as the case requires, and the nipple should be of a good size.

Hygiene of Dentition.—It seems to be popularly supposed that the fact that a child has reached the period of teething is sufficient explanation of almost any disease from which it may suffer; convulsions, bronchitis, vomiting, indigestion, diarrhœa, constipation, skin eruptions, and other conditions are considered to be the result of the teething process, and the appropriate treatment is supposed to be purgative "teething powders," soothing syrups, and the gum lancet. Much harm results from such loose notions and practice. There can be no doubt that the cutting of a tooth may cause local irritation in the mouth, and general symptoms in the body, especially feverishness, restlessness, and general *malaise*. There can be no doubt that convulsions also may sometimes occur during teething, especially in rickety children. But when a teething child suffers from bronchitis, vomiting, or diarrhœa, it will usually be found that some other cause has been acting as well; the child has been unduly exposed to cold, or some dietetic experiment has been made on its stomach, or the bottle has been sour, or the laws of infant health have been violated somehow, or there is constitutional disease.

The moral of this is, that when a child is ill in the teething period, the remedy is not to be found in any one particular nostrum, but the whole of the conditions present must be taken into consideration.

"Teething Powders" are usually purgative, and very often contain calomel. It is not a good thing to give a child purgatives except it is distinctly costive, and the constipation cannot be relieved by diet. Habitual dosing with purgatives is to be avoided.

* *Deformities of the Mouth*, &c., by James Oakley Coles. See also on Cleft palate, in *Operations of Surgery*, by Jacobson.

"Soothing Syrups," when effective, usually contain some form of opium (or morphia). There are some remedies which children take well. Opium is not one of these. On the contrary, they are specially susceptible to its action, and it should never be given except under medical direction. Many an infant has been "soothed" once for all and finally by opiates.

As to the **use of the gum-lancet** doctors differ. When a child is in convulsions, or threatened with them, the lancet may be used on the chance of relief being obtained. When over the coming tooth the gum is red, hot, swollen, and tender, many hold that there are clear indications for the use of the lancet. But to use it as a matter of routine on a cool unreddened gum, just because the child is out of sorts, is a great mistake. The great principle for the treatment of teething is to maintain the health of the child by the healthiness of its diet and surroundings.

There is a notion, common amongst mothers, that it is undesirable to cure diarrhœa and certain other affections noticed during teething. This is a complete error, and one which sometimes leads to neglect of serious symptoms.

A teething child in this country will usually be found with something in its mouth, in the shape of a ring, pad, or stick, of indiarubber, coral,* bone, or ivory. The hard materials are to be condemned, and one would be inclined to discountenance even the indiarubber ring, lest dirt germs should be conveyed by it, for it is constantly falling from the mouth and being replaced. Practically, however, it does not appear to do harm, and it is undoubtedly a great gratification to most infants to possess some such appliance.

Care of the Milk Teeth.—A point very commonly neglected in the hygiene of infancy is the care of the first set of teeth. If these decay, and especially if they decay so far and cause such pain as to necessitate extraction, the second set are apt to be irregular and crowded.

The teeth should be cleaned twice daily as soon as there is a tooth to clean. It is a still better plan to clean them after food, especially starchy or sugary foods. Simple rubbing is not enough. It is best to use a brush. A little prepared chalk may be used also. If a greenish stain be seen where the tooth joins the gum, it is important to get this off; chalk is hardly sufficient for this; pumice powder is better, and it may be applied with a pointed piece of soft wood.

* The use of coral is of great antiquity. It was supposed to be a charm against evil spirits and the "evil eye." A coral and bells combines two charms against evil spirits.

It is important not to give children sweets after their teeth are cleaned; nurses have a habit of giving a child a sweet to suck as it goes to sleep at night. This is bad for the teeth.

It is best not to transfer saliva from one mouth to another. Nurses may do this when they put the spoon, or teat, or even some of the food from their own mouth to the child's. If the teeth do become carious, the practitioner can help to arrest the decay by making an application to the cavity of the tooth of a minute quantity of powdered nitrate of silver, plugging the cavity afterwards with cotton wool.

Vaccination.—This is usually performed before the child is three months old. There is nothing gained by postponing vaccination, for the predisposition to small-pox is marked in infancy, and the mortality at this period is high. If small-pox be prevalent in the neighbourhood hardly any age is too early for vaccinating. In cases of ill-health the practitioner may postpone the operation for two months at a time, and may repeat this postponement indefinitely. The presence of any skin eruption, especially eczema, is a reason for postponement. If one vaccinates an eczematous child the disease may affect the pocks and may spread from these as from a centre, and the vaccination will be credited with blame.

Of the safety and efficiency of good vaccination it is not necessary to speak here. There is no surgical procedure, however simple, in which the precautions of surgical cleanliness can be dispensed with. In addition to pure lymph, a clean arm, and a sterilised lancet, the scratches and pocks themselves must be kept clean. When one thinks of the dirtiness of some of the infants brought to public vaccinating stations, of the filth of their clothes and surroundings, the uncleanliness of those that nurse them, the various applications made to the arms by ignorant people, and the possible existence of discharging wounds and sources of septic infection on the persons of those with whom the infants come in contact, one cannot fail to be impressed with the small amount of evil that ever results from vaccination. There are even cases on record where inflammatory processes affecting a recently vaccinated arm have been pretty clearly traced to the influence of sewer gas poisoning.*

There is perhaps no better way of protecting the arms than by using a piece of boracic lint, secured in its place by two bracelets of plaster, strapping one above and one below the spot. A little boracic acid ointment may be used as well to prevent sticking.

* See Teale's *Dangers to Health*, Plate LXVI.

CHAPTER V.

ON THE SIGNIFICANCE OF CERTAIN CONDITIONS OBSERVED IN INFANCY.

THE following notes and references are likely to be of use to the student.

Unusual Size of the Head.—This may be a more or less natural condition. It is common in rickets, when the head is broad and flat, and prominent at the frontal and parietal bones. It is also noted in hydrocephalus (dropsy of the head), when the whole head tends to be globular, and the sutures of the skull to gape. The head varies very much in size. At birth the circumference of the head is greater than that of the chest, but in the second year of life in a well-developed child there should be little difference; but in ill-developed children the chest may remain relatively too small for four or five years. The following table, relating to children of good development, is taken from Keating's *Cyclopædia*, vol. i., where it is quoted from the *Third Report of the Clinical Hospital, Manchester*, by Dr. James Whitehead :—

No. of Cases observed.	Age.	Girth of Head in Inches.	Girth of Chest in Inches.	Difference between Head and Chest.
100	1 day, . .	13·75	12·94	Head more than chest, 0·81
66	6 to 12 weeks, .	15·25	14·25	,, ,, 1·00
75	6 to 8 months, .	16·68	15·58	,, ,, 1·10
71	11 to 13 ,, .	17·80	17·20	,, ,, 0·60
67	21 to 24 ,, .	18·38	17·85	,, ,, 0·53
50	34 to 36 ,, .	18·70	18·61	,, ,, 0·09
60	4 to 4½ years, .	19·20	19·72	Chest more than head, 0·50
46	6 to 6½ ,, .	19·51	20·76	,, ,, 1·25
40	9 to 10 ,, .	19·56	21·31	,, ,, 1·75
31	11 to 12 ,, .	20·00	23·46	,, ,, 3·46

Fontanelle—This is of large size, and closes late in rickets and in congenital syphilis, also in hydrocephalus. It is tense, hot,

and throbbing in meningitis, but also in fevers in general. It is depressed after much diarrhœa and in chronic wasting disease.

Parchment-like Spots where the skull is thin and yields under the fingers, found chiefly posteriorly (*craniotabes*) are often seen when rickets is combined with congenital syphilis, but also in simple rickets. See valuable papers by Dr. T. Barlow and Dr. Lees in *Trans. of Path. Soc.*, vol. xxxii., p. 323, and by Dr. Baxter, p. 361; also Dr. Barlow's article on "Craniotabes" in Heath's *Dictionary of Practical Surgery.*

Profuse Sweating from the Head, an early sign in rickets. See Jenner's lectures on Rickets, *Med. Times and Gazette*, 1860. Not many lectures 34 years old retain their value in so great a degree as these.

Squinting in the early weeks of life may mean nothing (see p. 21). It is sometimes due to abdominal irritation and is one symptom of meningitis. It is associated with convulsions, may follow acute diseases and is associated with congenital blindness, and in older children with defective vision.

Inflammation of the Eyelids with Purulent Discharge in the Newly Born.—See *Prevention of Purulent Ophthalmia*, p. 98.

Obstruction of the Nostrils (Snuffles) in Early Infancy.—This is one symptom of congenital syphilis. It is due to coryza. Discharges from nose and excoriation on lip and at corners of mouth are associated with this, and characteristic eruptions are also seen. The student is referred to well illustrated articles in Ashby and Wright's text-book, chap. xx., and Owen's *Surgical Diseases of Children.*

Habitually Sleeping with the Mouth Open and keeping the Mouth Open by Day.—This is a sign of nasal or pharyngeal obstruction. The child must be carefully examined for large tonsils and for post-nasal adenoid growths. Chronic obstruction in the respiratory passages impairs health and development, and deafness and defective mental acuteness are found associated with this condition. Removal by operation is necessary and is often followed by a singular amount of benefit.

Marked Dilation of the Nostrils at each inspiration is a sign of impeded respiration, but a slight degree is seen in the quickened breathing of fever.

Puffiness of the Eyes and the Root of the Nose.—As this may be an indication of renal defect, the urine must be examined for albumen, &c.

Paralysis of One Side of the Face for some time after

birth. This is probably due to bruising of one side of the face by the blade of the midwifery forceps, which has compressed the facial nerve. It may also occur after labours prolonged and difficult, but otherwise apparently normal (*Henoch* and others). The prognosis is usually good. See vol. iv. of Keating's *Cyclopædia*, p. 804.

Enlarged Glands.—If under jaw and in the side of the neck, look for carious teeth, sore throat, and eruptions on ears, face, and scalp. If at nape of neck or behind the ears, examine scalp for skin eruptions and for *pediculi* (lice).

Late teething is common in rickets.

Gums, spongy, swollen, bleeding. See *Scurvy*, p. 46.

The child constantly **oscillates the head,** throwing it back and burrowing in the pillow. Sign of pain in the head, but may be due to ear-ache.

A swelling on the head of the new born, which lasts for weeks and becomes very hard. See *Cephalhæmatoma*, p. 4.

A considerable **swelling on one side of the neck,** especially the right, found *at birth* or soon after, and becoming very hard at a subsequent period. This is hæmatoma of the sterno-mastoid, a very rare condition. There is a good account of this in Henoch's work, part i., section 4. The prognosis is very favourable.

For **swelling of the Mammæ** and **Mastitis neonatorum** see p. 15.

Loss of Power in one Arm or one Leg.—This is very likely "infantile paralysis," but before coming to such a conclusion remember that it is possible that the child may have bruised the part by a fall, or that the limb may have been wrenched by careless lifting or by forcing it into a sleeve at an awkward angle. Occasionally such a condition is produced during birth, especially in pelvic presentations. See Ashby and Wright, *op. cit.*, p. 23, *Obstetrical paralysis.* Amongst the injuries produced by rough lifting, &c., we may mention subluxation of the head of the radius from the orbicular ligament (M'Nab's displacement. See Heath's *Dictionary of Surgery*, art. "Dislocation of Radius," and Lindeman, *Brit. Med. Journ.*, August, 1885).

Bent Collar Bones, common in rickets; but if on one side only, perhaps due to an overlooked fracture.

Series of Beads on the Ribs, rickety rosary (see p. 44). Pigeon breast, ribs sinking in at the sides of the chest at each inspiration—all common effects of rickets.

Clubbing of the Ends of the Fingers means some obstruc-

tion to the circulation in chest. It is seen, for instance, in congenital heart affections, and in tubercular lung disease.

A cystic swelling in place of one or more vertebral spines; a birth defect in the spinal column, *spina bifida*. See Heath's *Dictionary of Surgery*.

General Weakness of the Spine, so that there is a uniform roundness of the back and shoulders when the child sits up, but the spine becomes quite straight when the child is laid horizontally on its face. The mother is probably alarmed, and says that the spine "is growing out." This is due to weakness of muscles and ligaments, and is common in rickety and debilitated children, and must not be confused with angular curvature from diseased bone.

The Feet Turn in, the Knees tend to Knock.—This again is often due to weak muscles and relaxed ligaments, and must be distinguished from deformity due to contracted tendons or curved bones.

When a child who has once walked ceases, without obvious cause, to be able to do so, this is strongly suggestive of the onset of rickets. So is lateness in beginning to stand and walk.

Abdominal Distension.—The most *serious* cause of such distension is tubercular peritonitis and mesenteric disease. The public have some idea of this, and a large number of those infants who have large bellies and much diarrhœa are erroneously supposed by their mothers to be suffering from "consumption of the bowels." The most *common* cause is distension from flatulent accumulation, especially in rickets, when the abdominal walls are weak, the intestinal coat deficient in tone, and the digestive processes disordered. In fact, "pot-belly" is a characteristic sign of this disease. The abdomen under such circumstances often shows a furrow along the central line, and here the recti muscles yield and separate, and when the child tries to sit up there may be a bulging of the intestines between them.

Swelling in the Groin may be due to inguinal hernia, but possibly is due to a descending testicle. Enlarged glands are not uncommon, especially when there is irritation in and around the genital organs.

Rashes on the Skin.—We will only mention here that gastro-intestinal irritation in infants is very apt to be associated with papular rashes on the skin. These will consist of small raised round spots or little wheals. The student may refer to text-books under the heads of Strophulus, Lichen infantum, Lichen urticatus, &c.

"Red-gum" is the popular term for Strophulus. Erythematous rashes, especially when there are raised and reddened patches of skin, are associated commonly with rheumatism, and the heart, &c., must be carefully examined. See Dr. Cheadle's work on *The Rheumatic State in Childhood.*

The roseolous rash of syphilis must also be born in mind, and the mucous tubercles and soreness and fissures around the anus which accompany this disease.

"Growing Pains."—This is a vague, unsatisfactory term. The painful region must be examined. The cause is often rheumatism.

Marked Pallor and Anæmia, in absence of obvious disease, may be due to want of fresh air and of sunlight, to over-heated rooms, bad sanitary conditions, and to many other causes. It may be due to deficiency of nitrogenous material in the diet; if so, great improvement will follow the use of meat juice, &c. This will sometimes effect a cure, even without cod-liver oil and iron.

Bleeding from Vagina, and perhaps from the rectum also, may occur in the early days of life. It is attributable to congestion in the pelvic veins consequent upon ligature of the cord, and is not a serious symptom.

Catarrhal Discharge from the Vulva may be due to want of cleanliness or other local irritation in strumous girls, and there may even be a considerable amount of vulvitis. An unjustified suspicion of foul play is sometimes raised by this condition.

Blood in the Urine is one sign of scurvy. See p. 46.

Black or very dark Motions.—On meconium, see p. 10. May be due to iron or bismuth taken as medicine, or to digested blood. The scource may be blood swallowed by the infant, as from a fissure in the mother's nipple, or there may have been hæmorrhage from the child's own nose or mouth. Occasionally may be caused by ulceration in stomach or bowels, and is then of very grave importance. Refer to authorities under head of Melæna neonatorum and also Hæmophilia neonatorum. See for instance Winckel's *Midwifery*, Part viii., chap. xii.; Ashby and Wright, *op. cit.*, chap. ii; Goodhart, *op. cit.*, chap. iv.

Green Motions.—Motions of this colour are often seen when there is irritation and indigestion in the stomach and intestines, and some gastro-enteric catarrh. The exact cause is disputed. We are not aware that this condition supplies any accepted indication for varying the ordinary dietetic and medicinal treatment of such food disorders.

Expectoration is *not* a symptom in infancy. An adult with bronchitis will expectorate freely; an infant will not do so at all. It may, however, swallow its phlegm and subsequently vomit it.

Crying continually without obvious cause.

Here is a short list of possible reasons.

1. Hunger.
2. Indigestion, flatulence, and stomach-ache are exceedingly common causes.
3. Cold. The extremities may be chilled. The bed clothes may be inadequate.
4. The child may be over-heated by clothes, and may feel hot and uncomfortable.
5. Cramp from lying long in one position.
6. Some constriction by dress, a pin pricking, crumbs in the bed.
7. Ear-ache.
8. Pain from teeth.
9. *Malaise*, and thirst, and head-ache from some rise of temperature.
10. Urinary troubles, phimosis, and local irritation.
11. Rheumatic pains.
12. Recent fall, or strain, or bruise overlooked.
13. Bites and stings of insects.

APPENDIX.

ON THE EXAMINATION OF BREAST MILK.

It is no easy matter to form a reliable opinion on the nutritive value of the milk of any particular woman, from the examination of a single specimen. Chemical analysis by an expert is of great value, but several analyses must be made before satisfactory conclusions can be arrived at. The composition of milk from the same breast varies under different conditions. For example, the first, middle, and last portions drawn at one milking or suckling vary in composition, as the following observations by Harrington show :—

	Fat.	Total Solids.	Water.	Ash.
"Fore milk"—*i. e.*, first portion drawn, . .	3·88	13·34	86·66	0·85
"Middle milk," . .	6·74	15·40	84·60	0·81
"Strippings"—*i. e.*, last portion drawn, . .	8·12	17·13	82·87	0·82

Hence, if we wish to obtain a sample for analysis the infant should suckle for four or five minutes, and then by means of a breast pump, $1\frac{1}{2}$ to 2 ozs. may be drawn.

In interpreting the results of the analysis the most important points to notice, as Rotch says, are the amount of fat and the amount of albuminoids present in the milk. If the fat is low and the albuminoids high the milk is not good. The following table, taken from Rotch, will be some guide in forming a judgment on the results of milk analyses :—

	Normal Milk.	Poor Milk.	Over Rich Milk.	Bad Milk.
Fat, . .	4·0	1·50	5·10	0·80
Albuminoids, .	1 to 2	2·40	3·50	4·50
Sugar, . .	7·0	4·00	7·50	5·00
Ash, . .	0·2	0·09	0·25	0·09
Total solids, .	12 to 13	7·99	16·35	10·39
Water, . .	88 to 87	92·01	83·65	89·61
	100·00	100·00	100·00	100·00

There are, however, two methods of clinical examination which, taken together, are very useful. They are not equal in value to a thorough analysis, but they are easy of application.

The first is to take the **specific gravity.** This can be done with an ordinary urinometer.

The second is to **estimate the amount of fat** by means of Marchand's *Lactobutyrometer.* This instrument is shown in Fig. 29. It consists of a glass tube which is divided into three portions. The lowest is for milk, the middle for ether, the highest for alcohol, and this portion is graduated in tenths of a gramme. In using the apparatus it is first filled with milk by a pipette to the mark M. Then with a second pipette ether is added as far as the mark Æ. The ether should at 15° C. have a specific gravity of from 0·725 to 0·730. The tube is then securely corked and shaken up for several minutes. Alcohol is next added as far as the mark Al. Absolute alcohol is ordered in the directions issued with the apparatus, but redistilled methylated spirit will answer instead. After renewed shaking, the tube is placed in a water bath for ten or twelve minutes at a temperature of 40° C. (104° F). Unless the cork be well secured it will be expelled and the experiment spoiled. After cooling there will be seen at the surface of the mixture, in the tube, a clear oil-like stratum of fat, and the number of degrees to which this corresponds can be read off.

Fig. 29.

In this process the ether first dissolves out the fat, then, when the alcohol is added, the fat is thrown out and rises to the surface, except a minute residuum. The following table shows

the percentage of fat indicated by the number of degrees registered, including the small unseparated residuum :—

Number of Degrees registered in Lactobutyrometer.	Percentage of Fat indicated.	Number of Degrees registered in Lactobutyrometer.	Percentage of Fat indicated.
1	1·339	7	2·563
1·5	1·441	7·5	2·655
2	1·543	8	2·767
2·5	1·645	8·5	2·869
3	1·747	9	2·971
3·5	1·849	9·5	3·073
4	1·951	10	3·175
4·5	2·053	10·5	3·277
5	2·155	11	3·379
5·5	2·257	11·5	3·481
6	2·359	12	3·583
6·5	2·461	12·5	3·685

And so on. n degrees $= 1{\cdot}339 + n \times 0{\cdot}204$.

Professor Monti, who has lately published a series of observations made with this instrument,* adds a drop of 3 per cent. solution of caustic soda to the milk to assist the separation.

In this article he shows that the specific gravity and the amount of fat bear no constant relation to each other. One may increase, while the other decreases; or both may rise and fall together. He thus sums up the results obtained by him. 1. When human milk has a specific gravity of 1,030 to 1,035 and at same time 3 to 5 per cent. of fat, the *specific gravity and fat percentage being thus correspondingly high*, and when during the period of suckling there is only a slight diminution in these factors, the milk may be considered good, and it may be expected that the child will thrive on it. 2. Menstruation has no constant influence on the specific gravity and fat percentage. In certain cases, however, there is an increased amount of fat which is lost again after the cessation of the period. 3. When, during lactation, there is a high specific gravity, but only a low percentage of fat the children do not thrive satisfactorily, and the milk must be looked upon as abnormal. 4. A high percentage of fat may be induced temporarily by pathological conditions, such as mastitis or febrile condition, in the suckling woman. 5. On account of long-continued pathological processes, there may be a rapid or gradual decrease in the fatty constituent of the milk.

* *Archiv für Kinderheilkunde*, vol. xiii., part 1.

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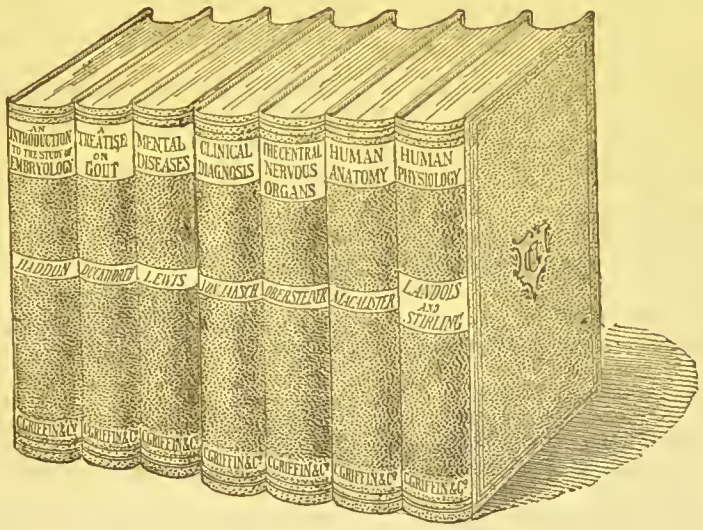

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